

CONSTRUCTION REQUIREMENTS
AND DETAIL DRAWINGS
FOR
SANITARY SEWERS AND APPURTENANCES

for

LOWER POTTS GROVE TOWNSHIP AUTHORITY
MONTGOMERY COUNTY, PENNSYLVANIA

**CONSTRUCTION REQUIREMENTS
AND DETAIL DRAWINGS
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SECTION 1

GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS

Wherever used in this manual for Sewer Construction the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

AUTHORITY - Lower Pottsgrove Township Authority

DETAIL DRAWINGS - The detailed construction drawings provided in this Manual for Sewer Extension Construction.

DEVELOPER - The person, firm or corporation, ultimately responsible for construction of the sewer with whom **AUTHORITY** and/or **TOWNSHIP** has entered into the Agreement, as well as agents acting on behalf of **DEVELOPER**, including the **DEVELOPER's CONTRACTOR**.

DEVELOPER's AGREEMENT - The written agreement between **TOWNSHIP** and **DEVELOPER** or **AUTHORITY** and **DEVELOPER** covering the Work to be performed.

DEVELOPER's CONTRACTOR (CONTRACTOR) - The person, firm or corporation constructing the sewer extension on behalf of **DEVELOPER** if other than Developer.

DEVELOPER's Drawings - The drawings which show the character and scope of the Work to be performed and which have been prepared by **DEVELOPER** and approved by **ENGINEER** and are referred to in the Sewer Extension Agreement.

ENGINEER - The person, firm or corporation named as such by the **AUTHORITY**.

LAWS AND REGULATIONS: Laws or Regulations - Laws, rules, regulations, ordinances, codes and/or orders.

MANUAL - The Manual for Construction Requirements and Detail Drawings for Sanitary Sewers and Appurtenances.

PROJECT - The total construction of the sanitary sewer extension.

PROJECT INSPECTOR - The authorized representative of the **AUTHORITY** assigned to the site or any part thereof for inspection of construction.

SHOP DRAWINGS - All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for **DEVELOPER** to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by **DEVELOPER** to illustrate material or equipment for some portion of the Work.

SPECIFICATIONS - Those portions of the Manual consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

SUPPLIER - A manufacturer, fabricator, supplier, distributor, materialman or vendor.

TOWNSHIP - Lower Pottsgrove Township.

UNDERGROUND FACILITIES - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage conveyance, traffic or other control systems or water.

WORK - The entire completed construction of the sewer extension or the various separately identifiable parts thereof required to be furnished under this Manual. Work is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by this Manual.

ARTICLE 2 - PRELIMINARY MATTERS

Before Starting Construction:

- 2.1. The DEVELOPER must provide 10 days prior notification to the AUTHORITY before undertaking the project.

Preconstruction Conference:

- 2.2. At least 10 days prior to construction but before the DEVELOPER's CONTRACTOR starts the Work at the site, a conference attended by DEVELOPER's CONTRACTOR, TOWNSHIP/AUTHORITY, ENGINEER and others as appropriate will be held to discuss procedures for handling Shop Drawings and other submittals, and to establish a working understanding among the parties as to the Work.

ARTICLE 3 - DEVELOPER'S RESPONSIBILITIES

Supervision and Superintendence:

- 3.1. DEVELOPER shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Manual. DEVELOPER shall be solely responsible for the means, methods, techniques, safety, sequences and procedures of construction. DEVELOPER shall be responsible to see that the finished Work complies accurately with the Manual.

- 3.2. DEVELOPER shall keep on the Work at all times during its progress a competent resident superintendent. The superintendent will be DEVELOPER's representative at the site and shall have authority to act on behalf of DEVELOPER. All communications given to the superintendent shall be as binding as given to DEVELOPER.

Labor, Materials and Equipment:

- 3.3. DEVELOPER shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Manual. DEVELOPER shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Manual, all Work at the site shall be performed during "regular" working hours between 7 AM and 7 PM, and DEVELOPER will not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without AUTHORITY's written consent given after prior written notice.
- 3.4. All materials and equipment shall be of good quality and new, except as otherwise provided in the Manual. If required by ENGINEER, DEVELOPER shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable Supplier except as otherwise provided in the Manual; but no provision of any such instructions will be effective to assign to ENGINEER, or any of ENGINEER's consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 5.7.

Substitutes or "Or-Equal" Items:

- 3.5.1. Whenever materials or equipment are specified or described in the Manual by using the name of a proprietary item or the name of a particular Supplier the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other Suppliers may be accepted by ENGINEER if sufficient information is submitted by DEVELOPER to allow ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named. Requests for review of substitute items of material and equipment will not be accepted by ENGINEER from anyone other than DEVELOPER. If DEVELOPER wishes to furnish or use a substitute item of material or equipment, DEVELOPER shall make written application to ENGINEER for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified.
- 3.5.2. If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Manual, DEVELOPER may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to ENGINEER, if DEVELOPER submits sufficient information to allow ENGINEER to determine that the substitute proposed is equivalent to that indicated or required by the

Contract Documents. The procedure for review by ENGINEER will be similar to that provided in paragraph 3.5.1. as applied by ENGINEER.

- 3.5.3. ENGINEER will be allowed a reasonable time within which to evaluate each proposed substitute. ENGINEER will be the sole judge of acceptability, and no substitute will be ordered, installed or utilized without ENGINEER's prior written acceptance which will be evidenced by an approved Shop Drawing. AUTHORITY may require DEVELOPER to furnish at DEVELOPER's expense a special performance guarantee or other surety with respect to any substitute. ENGINEER will record time required by ENGINEER and ENGINEER's consultants in evaluating substitutions proposed by DEVELOPER and in making changes in the Manual occasioned thereby. Whether or not ENGINEER accepts a proposed substitute, DEVELOPER shall reimburse AUTHORITY for the charges of ENGINEER and ENGINEER's consultants for evaluating each proposed substitute.

Record Documents:

- 3.6. DEVELOPER shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Directive Changes, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 5.4) in good order and annotated by the DEVELOPER to show all changes made during construction and all lateral locations and depths. These record documents together with all approved samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these record documents, samples and Shop Drawings will be delivered to ENGINEER for AUTHORITY.

Shop Drawings and Samples:

- 3.7. After checking and verifying all field measurements and after complying with applicable procedures specified in this manual, DEVELOPER shall submit to ENGINEER for review and approval, seven copies of all Shop Drawings, which will bear a stamp or specific written indication that DEVELOPER has satisfied DEVELOPER's responsibilities under the Manual with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable ENGINEER to review the information as required.
- 3.8. ENGINEER will review and approve with reasonable promptness Shop Drawings and samples, but ENGINEER's review and approval will be only for conformance with the design concept of the Project and for compliance with the information given in the Manual and shall not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Manual) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the Item functions. DEVELOPER shall make corrections required by ENGINEER, and shall return the required number of corrected copies of Shop Drawings and submit as required new samples for review and approval. DEVELOPER shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

- 3.9. ENGINEER's review and approval of Shop Drawings or samples shall not relieve DEVELOPER from responsibility for any variation from the requirements of the Manual unless DEVELOPER has in writing called ENGINEER's attention to each such variation at the time of submission as required by paragraph 3.7 and ENGINEER has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval; nor will any approval by ENGINEER relieve DEVELOPER from responsibility for errors or omissions in the Shop Drawings or from responsibility for having complied with the provisions of paragraph 3.7.
- 3.10. Where a Shop Drawing or submittal is required by the Manual, any related Work performed prior to ENGINEER's review and approval of the pertinent submission will be the sole responsibility of DEVELOPER and may be subject to rejection.

ARTICLE 4 - AUTHORITY'S RESPONSIBILITIES

- 4.1. AUTHORITY'S responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 7.4.

ARTICLE 5 - AUTHORITY'S STATUS DURING CONSTRUCTION

AUTHORITY's Representative:

- 5.1. ENGINEER will be AUTHORITY's representative during the construction period.

Visits to Site:

- 5.2. As may be directed by AUTHORITY, ENGINEER will make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Manual. ENGINEER will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for AUTHORITY a greater degree of confidence that the completed Work will conform to the Manual. On the basis of such visits and on-site observations as an experienced and qualified design professional, ENGINEER will keep AUTHORITY informed of the progress of the Work and will endeavor to guard AUTHORITY against defects and deficiencies in the Work.
- 5.3. ENGINEER will not be responsible for DEVELOPER's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and ENGINEER will not be responsible for DEVELOPER's failure to perform or furnish the Work in accordance with the Manual.
- 5.4. ENGINEER will not be responsible for the acts or omissions of DEVELOPER or of DEVELOPER's CONTRACTOR, any Supplier, or of any other person or organization performing or furnishing any of the Work.

Project Inspector:

- 5.5. **AUTHORITY** will either appoint an inspector or request that **ENGINEER** provide a project inspector to observe the performance of the work. Inspection shall be provided solely for the purpose and to the extent necessary to insure conformance with the Manual construction requirements.

Authorized Variations in Work:

- 5.6. **ENGINEER** may authorize minor variations in the Work from the requirements of the Manual only in accordance with the procedures described in Section 3 of the Manual.

Rejecting Defective Work:

- 5.7. **ENGINEER** or the **AUTHORITY's DESIGNATED REPRESENTATIVE** will have authority to disapprove Work which **ENGINEER** or **REPRESENTATIVE** believes to be defective, and will also have authority to require special inspection or testing of the Work as provided in paragraph 7.9 whether or not the Work is fabricated, installed or completed.

Shop Drawings:

- 5.8. In connection with **ENGINEER's** responsibility for Shop Drawings and samples, see paragraphs 3.7 through 3.10 inclusive.

ARTICLE 6 - CHANGES IN THE WORK

- 6.1. All changes in project shall be in accordance with Section 3 of the Manual.

ARTICLE 7 - WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

- 7.1. **DEVELOPER** warrants and guarantees to **AUTHORITY** and **ENGINEER** that all Work will be in accordance with the Manual and will not be defective. Prompt notice of all defects shall be given to **DEVELOPER**. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in this Article.

Access to Work:

- 7.2. **ENGINEER** and other representatives of **AUTHORITY**, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. **DEVELOPER** shall provide proper and safe conditions for such access.

Tests and Inspections:

- 7.3. DEVELOPER shall give ENGINEER timely notice (Minimum 48 hours) of readiness of the Work for all required inspections, tests or approvals.
- 7.4. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) to specifically be inspected, tested or approved, DEVELOPER shall assume full responsibility therefor, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval. DEVELOPER shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with AUTHORITY's or ENGINEER's acceptance of a Supplier of materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to DEVELOPER's purchase thereof for incorporation in the Work.
- 7.5. All inspections, tests or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by organizations acceptable to AUTHORITY and DEVELOPER (or by ENGINEER if so specified).
- 7.6. If any Work (including the work of others) that is to be inspected, tested or approved is covered without concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation. Such uncovering shall be at DEVELOPER's expense unless DEVELOPER has given ENGINEER timely notice of DEVELOPER's intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.
- 7.7. Neither observations by ENGINEER nor inspections, tests or approvals by others shall relieve DEVELOPER from DEVELOPER's obligations to perform the Work in accordance with the Manual.

Uncovering Work:

- 7.8. If any Work is covered contrary to the request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER's observation and replaced at DEVELOPER's expense.
- 7.9. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, DEVELOPER, at ENGINEER's request, shall uncover, expose or otherwise make available for observation, inspection or testing as ENGINEER may require, that portion of the Work in question. DEVELOPER shall furnish all necessary labor, material and equipment. If it is found that such Work is defective, DEVELOPER's CONTRACTOR shall bear all direct, indirect and consequential costs of such uncovering, exposure, observation, inspection and testing, and of satisfactory reconstruction (including, but not limited to, fees and charges of engineers, architects, attorneys and other professionals).

Correction or Removal of Defective Work:

- 7.10. If required by ENGINEER, DEVELOPER shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by ENGINEER, remove it from the site and replace it with nondefective Work. DEVELOPER shall bear all direct, indirect and consequential costs of such correction or removal (including but not limited to fees and charges of engineers, architects, attorneys and other professionals) made necessary thereby.

SECTION 2

REFERENCE STANDARDS

ARTICLE 1 - QUALITY ASSURANCE

- A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The date of the standard is that in effect as of the DEVELOPER's Agreement date.
- C. When required by individual Specification section, obtain copy of standard. Maintain a copy at jobsite during submittals, planning, and progress of the specific work, until Substantial Completion.

ARTICLE 2 - SCHEDULE OF REFERENCES

AA	Aluminum Association 818 Connecticut Avenue, N.W. Washington, DC 20006
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001
ACI	American Concrete Institute Box 19150 Reford Station Detroit, MI 48219
AISC	American Institute of Steel Construction 1221 Avenue of the Americas New York NY 10020
AISI	American Iron and Steel Institute 1000 16 th Street, N.W. Washington, DC 20036
AMCA	Air Movement and Control Association 30 West Broadway New York, NY 10018
ASME	American Society of Mechanical Engineers 345 East 47 th Street New York, NY 10017

ASTM	American Society for Testing Materials 1916 Race Street Philadelphia, PA 19103
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
AWS	American Welding Society 2501 NW 7 th Street Miami, FL 33125
CRSI	Concrete Reinforcing Steel Institute 180 North LaSalle Street Suite 2110 Chicago, IL 60601
EJMA	Expansion Joint Manufacturerers Association 708 Westchester Avenue White Plains, NY 10604
FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg., 197 Washington, DC 20407
IEEE	Institute of Electrical and Electronics Engineers 345 East 47 th Street New York, NY 10017
IMIAC	International Masonry Industry All-Weather Cou International Mansonry Institute 823 15 th Street, N.W. Washington, DC 20005
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
NEMA	National Electrical Manufacturers' Association 2010 L. Street, N.W. Washington, DC 20037

NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 20076
PCI	Prestressed Concrete Institute 20 North Wacker Drive Chicago, IL 60606
PennDOT	Pennsylvania Department of Transportation Harrisburg, PA 17120
PS	Product Standard U.S. Department of Commerce Washington, DC 20203
SDI	Steel Door Institute 712 Lakewood Center North Cleveland, OH 44107
SSPC	Steel Structures Painting Council 4400 Fifth Avenue Pittsburgh, PA 15213
UL	Underwriters Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

SECTION 3

PROCEDURES FOR PROJECT CHANGES

ARTICLE 1 - PROCEDURES

- A. AUTHORITY or ENGINEER may initiate changes by submitting letter of project change to the DEVELOPER.
 - 1. Description of the change, products, and location of the change in the Project.
 - 2. Supplementary or revised Drawings and/or Specifications.

- B. DEVELOPER may initiate changes by submitting a written notice to ENGINEER, containing:
 - 1. Description of the proposed changes.
 - 2. Statement of the reason for making the changes.
 - 3. Statement of compliance with Project Manual requirements.
 - 4. Documentation supporting need for change.
 - 5. No changes from the approved design shall be made without written authorization from the ENGINEER.

ARTICLE 2 - CONSTRUCTION CHANGE AUTHORIZATION

- A. In lieu of letter of project change, ENGINEER may issue a field Construction Change Authorization for CONTRACTOR to proceed with a change for subsequent inclusion in letter for project change.

- B. Authorization will describe changes in the Work including both additions and deletions.

- C. ENGINEER will sign and date the Construction Change Authorization in the field as authorization for the DEVELOPER to proceed with the changes.

- D. CONTRACTOR may sign and date the Construction Change Authorization to indicate agreement.

SECTION 4

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

ARTICLE 1 - SHOP DRAWINGS

- A. Present in a clear and thorough manner. Title each drawings with Project name and number.
- B. Identify field dimensions; show relation to adjacent or critical features of Work or products.
- C. Minimum Sheet Size: 8 1/2 x 11 inches.

ARTICLE 2 - PRODUCT DATA

- A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products.
- B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.
- C. Provide manufacturer's preparation, assembly, and installation instructions.

ARTICLE 3 - DEVELOPER'S CONTRACTOR REVIEW

- A. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Manual.
- B. Coordinate submittals with requirements of Work and Manual.
- C. Sign or initial each sheet of shop drawings and product data, and each sample label to certify compliance with requirements of Manual. Notify ENGINEER in writing at time of submittal, of any deviations from requirements of Manual.
- D. Do not fabricate products or begin work which requires submittals until return of submittal with ENGINEER's acceptance.

ARTICLE 4 - SUBMITTAL REQUIREMENTS

- A. Transmit submittals in accordance with approved procedures.

- B. Apply DEVELOPER's CONTRACTOR stamp, signed or initialed, certifying to review, verification of products, field dimensions and field construction criteria, and coordination of information with requirements of Work.
- C. Coordinate submittals into logical groupings to facilitate interrelation of the several Items.
- D. Submit number of opaque reproductions of shop drawings CONTRACTOR requires, plus three which will be retained by ENGINEER. Maximum number of copies not to exceed seven.
- E. Submit number of copies of product data DEVELOPER's CONTRACTOR requires, plus three copies which will be retained by ENGINEER. Maximum number of copies submitted not to exceed seven.
- F. Submit number of samples required by individual Specification sections.
- G. Submit under transmittal letter. Identify Project by title and number; identify Contract by number. Identify Work and product by Specification section and Article number.

ARTICLE 5 - RESUBMITTALS

- A. Make resubmittals under procedures specified for initial submittals; identify changes made since previous submittal.

ARTICLE 6 - ENGINEER REVIEW

- A. ENGINEER will review and return submittals within 15 working days.

ARTICLE 7 - DISTRIBUTION

- A. Distribute reproductions of shop drawings, copies of product data, and samples, which bear ENGINEER stamp of approval, to job site file, Record Documents file, subcontractors, suppliers, and other entities requiring information.

SECTION 5

TEMPORARY CONTROLS

ARTICLE 1 - DUST CONTROL

- A. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and provide positive means to prevent air-borne dust from dispersing into the atmosphere.

ARTICLE 2 - DIVERSION AND CARE OF WATER DURING STREAM CROSSINGS

- A. The DEVELOPER/CONTRACTOR must obtain the necessary permits for swamp area and stream crossings from the Pennsylvania Department of Environmental Resources Division of Dams and Waterways and the Pennsylvania Fish Commission. CONTRACTOR shall not perform any work in a stream channel, unless he has been notified that the required permit has been issued, and whether or not the permit is subject to stipulations or special conditions. CONTRACTOR shall take sufficient precautions to prevent pollution of swamp areas or streams with fuels, oils, bitumens, or other harmful materials. He shall conduct his operations in such a way that will minimize damage to the stream channel and stream banks, prevent erosion of stream banks and deposits of excess sediment in streams, or otherwise harm streams or the properties along streams.
- B. Diversion and care of water during swamp area or stream crossing and canal embankment excavation work shall consist of diverting and maintaining the flow during the construction period, and dewatering work areas. All permanent construction work shall be performed in areas free from water unless otherwise specifically authorized by ENGINEER. The finished structures and portions thereof shall be protected from damage by flowing water until completion of work.
- C. The CONTRACTOR shall lay the pipe in the dry by diverting streams and/or dewatering the swamp areas. In diverting streams, extreme care must be used to prevent property damage.
- D. The pipe across stream crossings shall be encased in concrete in accordance with the dimensions shown on the Detail Drawings. The pipe shall be installed on wood blocks in order to maintain the proper grade. If the material in swamp areas or stream bottoms is soft, forms shall be used to constrict the concrete encasement. Unsuitable material shall be removed to a depth at which stable, undisturbed earth or rock is encountered, not to exceed a depth below pipe invert of three (3) feet, or to the limits designated by the ENGINEER. Trench subbedding shall be backfilled with No. 3 crushed stone. If swamp areas or stream bottom is rock, forms shall not be used and, instead, the concrete shall be placed on firm rock below the pipe, and against firm rock on both sides of the pipe.

- E. After the concrete is placed, the balance of the trench under streams and their banks shall be backfilled with PA Select Granular Material. The trench over the encasement in swampy areas shall also be backfilled with PA Select Granular Material in accordance with Section 6 and the Detail Drawings, or as directed by the ENGINEER.
- F. Removal of Temporary Work: Unless otherwise authorized, all temporary protective structures and other works shall be removed upon completion of work. All banking and filling which is not part of the permanent work shall be removed to the original ground surfaces existing prior to beginning of work and all diversion channels, ditches, and other cavities shall be backfilled with embankment material, placed and compacted in accordance with Section 6. Materials used in temporary construction shall be disposed of to the satisfaction of the ENGINEER. Whenever the ENGINEER determines that the removal of sheeting and bracing will endanger completed work, he will direct that it be cut off not less than 2 feet below the ground surface, left in place, and backfilled. All temporary protective works shall be removed from the site after having served their purpose.

ARTICLE 3 - WATER CONTROL

- A. Provide methods to control surface water to prevent damage to the Project, the site, or adjoining properties.
 - 1. Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels and other construction areas, and to direct drainage to proper runoff.
- B. Maintain excavations and trenches free of water, provide and operate pumping equipment of a capacity to control water flow. Provide and place all necessary or other channels of adequate size to carry temporarily all streams, brooks, storm water or other water which may flow along or across the lines of the sewer. All flumes or channels thus utilized shall be tight so as to prevent drainage into trenches.
- C. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas, comply with applicable codes and regulations, and Article 2.

ARTICLE 4 - DEBRIS CONTROL

- A. Maintain all areas under CONTRACTOR's control free of extraneous debris.
- B. Initiate and maintain a specific program to prevent accumulation of debris.
 - 1. Provide containers for deposit of debris.
 - 2. Prohibit overloading of trucks to prevent spillages.
 - a. Provide periodic inspection to enforce requirements.

- C. Schedule periodic collection and disposal of debris.
 - 1. Provide additional collections and disposal of debris whenever the periodic schedule is inadequate.

ARTICLE 5 - SOIL EROSION SEDIMENTATION AND POLLUTION CONTROLS

- A. Plan and execute construction to control surface drainage to prevent erosion and sedimentation.
- B. Comply with Erosion and Sedimentation Control Hand Book, Montgomery County Conservation District, (Mailing Address: Montgomery County 4H Center, Rt. 113, P.O. Box 164, Creamery, PA 19430) and in accordance with DEVELOPER's approved plan.
- C. Pollutants such as fuels, lubricants, bitumens, raw sewage and other harmful materials shall not be discharged into or near rivers, streams and impoundments or into natural or manmade channels leading thereto. Wash water or waste from concrete mixing operations shall not be allowed to enter streams.

ARTICLE 6 - TRAFFIC CONTROL

- A. The CONTRACTOR shall provide and maintain access to and from all properties along the line of the work. The CONTRACTOR shall also provide temporary by-passes and bridges and maintain them in a safe and usable condition whenever, in the opinion of the ENGINEER, detouring of traffic to parallel routes cannot be done without hardship or excessive increase in travel by the public.
- B. Where single lane by-passes are provided, the CONTRACTOR shall furnish signalmen to control traffic operations and minimize delays.
- C. Where directed by the ENGINEER, the CONTRACTOR shall perform excavating, paving, and other operations on one-half of the road at a time to allow for movement of traffic.

ARTICLE 7 - DETOURS

- A. The CONTRACTOR shall set up and maintain all necessary detours to the satisfaction of the ENGINEER and the Pennsylvania Department of Transportation. The CONTRACTOR shall supply and erect all necessary signs along the routes approved by the ENGINEER and Pennsylvania Department of Transportation. The CONTRACTOR shall notify police, fire, school and Municipal officials as well as adjacent municipalities, if necessary. All proposed detours shall be marked clearly on a map and submitted to the ENGINEER two weeks in advance of the time the detour will go into effect. The CONTRACTOR will submit the plans to the Pennsylvania Department of Transportation and/or Municipality(s) affected by the detour for approval. Signs used for marking all detours shall be as approved by the Pennsylvania Department of Transportation and/or

Municipality(s) affected by the detour and shall be securely fastened in place to prevent vandalism.

ARTICLE 8 - SAFEGUARDS

- A. The CONTRACTOR shall provide, erect and maintain adequate barricades, warning signs and lights at all excavations, closures, detours and points of danger.
- B. All haul routes proposed to be used by the CONTRACTOR shall be approved by the Municipality prior to the start of any work.

SECTION 6
TRENCHING

ARTICLE 1 - GENERAL

1.01 WORK INCLUDED

- A. Excavated trenches for sewers and structures as shown on Drawings.
- B. Compacted bedding and compacted fill over sewers to subgrade elevations.

1.02 RELATED WORK

- A. Section 5 - Temporary Controls: Control of Water, Traffic Control.

1.03 REFERENCES

- A. Pennsylvania Department of Highways Bulletin 408.

1.04 SUBMITTALS

- A. The CONTRACTOR, ten (10) days before beginning any earthwork, shall submit to the ENGINEER the following information:
 - 1. Location of source(s) for all types of fill materials.
 - 2. Numbers and types of compacting equipment to be used.
 - 3. Starting date of earthwork operations.
- B. The CONTRACTOR shall submit to a testing lab for testing and review one 100-pound representative bag sample of each kind of fill material at least ten (10) days prior to fill or backfill operations. By submitting samples of these materials, the CONTRACTOR agrees and guarantees that fill materials actually used in the construction will conform to the accepted samples submitted. The testing lab report shall be delivered to the Engineer five (5) days prior to the start of fill or backfill operations.

1.05 LINES AND ELEVATIONS

- A. Elevations
 - 1. Pipes shall be laid true to the lines and elevations shown on the Plans. Work not conforming to the elevation shall be corrected by the CONTRACTOR at his own expense.

B. Locations of Lines

1. The locations of the proposed lines are shown on the Plans.
2. Approximate elevations are shown on the Plans.
3. The ENGINEER reserves the right to make changes in lines and elevations of pipe lines and in locations of pipes and manholes when such changes may be necessary or advantageous.

1.06 SAFETY REQUIREMENTS

A. Provide and maintain barricades, signs, lights, etc. as required to protect the public.

B. Excavation Near Existing Structures

1. Excavations near structures will not be allowed closer to the structure than the depth of the excavation below the existing structure foundation plus two (2) feet without shoring the excavation with sheeting.

C. Underground Utilities

1. Attention is directed to the fact that there may be water pipes, drains and other utilities in certain locations. Prior to the start of any work, the CONTRACTOR shall independently confirm the locations of all existing utilities in the Project area and shall comply with the provisions of the underground utility line protection law.

D. Mud, Dirt and Debris

1. During the progress of the work, the CONTRACTOR shall conduct his operation and maintain the area of his activities so as to minimize the creation and dispersion of dust. If the AUTHORITY decides that it is necessary to use a water truck or dust control inhibitor for more effective dust control, the CONTRACTOR shall furnish the material, load, deliver, and distribute same as directed.
2. The CONTRACTOR shall maintain existing access roads and facilities free of mud, dirt and debris.

1.07 CARE AND RESTORATION OF PROPERTY

A. Excavating machinery and cranes shall be operated with care to prevent damage to existing structures and/or wires.

B. On paved surfaces, the CONTRACTOR shall not use or operate tractors, bulldozers, or other power operated equipment, the treads or wheels of which will cut or otherwise damage such surfaces.

- C. All surfaces which have been damaged by the CONTRACTOR's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operations. Suitable materials and methods shall be used for such restoration.
- D. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

1.08 WORK IN PRIVATE RIGHT-OF-WAY

- A. Right-of-way, if required, to be secured by DEVELOPER. Protect from injury all property including land, ornamental shrubs and trees, fences, and other improvements thereto that may exist; and replace in kind all those damaged.
- B. Pay all claims for property damage, trespass occupation for damage outside the right-of-way.
- C. It shall be the DEVELOPER's responsibility to obtain all other rights-of-way for access to the Construction site. Written authorization from all affected property owners shall be provided to the ENGINEER before beginning work in the affected area.

1.09 REGULATIONS

- A. During excavation and backfill in State, County and Township highways, the CONTRACTOR shall be governed by the conditions, restrictions and regulations made by the State Highway Department, Pennsylvania Department of Transportation, the County Commissioners, and Municipal Officials. All such regulations shall be in addition to the ones set down in these Specifications.

ARTICLE 2 PRODUCTS

2.01 MATERIALS - GENERAL

- A. In general, materials used for fill (site fill, structural fill, backfill, etc.) shall be foreign materials and be brought to the site from acceptable sources. The use of excavated materials as backfill will be approved on a case by case basis.
- B. Present on site materials excavated in the course of construction which are deemed suitable by the ENGINEER may be stored on the site for use as backfill.
- C. All material, whether from the excavations or from borrow, shall be of such nature that after it has been placed and properly compacted, it will make a dense, stable fill. It shall not contain vegetation, cinders, ashes, refuse, masses of roots, stones larger than sizes allowed in the following paragraph, or porous matter. Organic matter shall not exceed minor quantities and shall be well distributed.

2.02 SELECT MATERIALS

- A. Coarse Aggregate AASHTO No. 8.
- B. Coarse Aggregate AASHTO No. 57.
- C. Coarse Aggregate PA No. 2A.

ARTICLE 3 EXECUTION

3.01 GENERAL DESCRIPTION

- A. Make all excavations in such manner and to such widths as will give suitable room for building the structures.
- B. Be solely responsible for the stability of excavations and provide all sheeting, shoring, bracing, etc., required to retain excavations.
- C. The excavation, dewatering, sheeting and bracing shall be carried out in such manner as to eliminate any possibility of undermining or disturbing the foundations of any existing structure or any work previously completed under this Contract, unless otherwise allowed in writing by the ENGINEER.
- D. Where damage is liable to result from withdrawing sheeting, the sheeting shall be left in place. Sheeting shall be left in place only when agreed to or requested by the ENGINEER.
- E. Excavated unsuitable and excess material shall be removed from the site. Any excavated material, deemed suitable by the ENGINEER, may be reused as backfill if authorized by the ENGINEER.
- F. Provide and operate pumping equipment necessary to maintain all excavations free of subsurface and stormwater during the life of construction. Dispose of pumped water as permitted by the ENGINEER in such a manner that operation and storage areas and other facilities are not flooded.

3.02 SEPARATION OF SURFACE MATERIALS

- A. From areas within which excavations are to be made, loam and topsoil shall be carefully removed and separately stored to be used again; or, if CONTRACTOR prefers not to separate surface materials, he shall furnish, clean backfill and topsoil at least equal in quantity and quality to that excavated.
- B. When excavations are to be made in paved surfaces, the pavement shall be cut and removed so as to provide a clean uniform edge with a minimum disturbance of remaining pavement.

- C. If pavement is removed in large pieces, it shall not be mixed with other excavated material, but shall be disposed of away from the site of the work before the remainder of the excavation is made.

3.03 SHEETING AND BRACING

- A. Where necessary, particularly for safety or to prevent disturbance, damage or settlement of adjacent structures, pipelines, utilities, improvements or paving, excavations shall be sheeted and braced. Any damage to new or existing structures occurring through settlement, water or earth pressure, or other causes due to inadequate bracing, through negligence or fault of the CONTRACTOR in any other manner, shall be repaired by the CONTRACTOR.
- B. Where trenches or excavations exceed five (5') feet in depth, the CONTRACTOR shall, in advance of the start of the work, submit pipe installation and excavation procedures to the ENGINEER for his review. The information shall include complete details and descriptive data of materials and installation procedures for sheeting and bracing, trench boxes and excavation of side slopes as proposed to be used.
- C. Where sheeting or trench boxes are used, they must be designed by a Professional Engineer licensed to practice in the State of Pennsylvania. Said Engineer shall provide the CONTRACTOR with a certification signed and sealed by him stating that the design of the sheeting and bracing conforms to all applicable requirements of the Pennsylvania Construction Safety Code and the Occupational Health and Safety Act. Copies of this certification shall be submitted to the ENGINEER.
- D. The CONTRACTOR must follow the proposed sheeting plans submitted. No deviations may be made from the filed procedure without first submitting a revised sheeting and bracing plan, signed and certified as required for the original submission, by the same licensed Professional Engineer who prepared the original submission.
- E. All sheeting and bracing not to be left in place shall be carefully removed in such a manner as not to endanger the construction or other structures. All voids left or caused by withdrawal of sheeting shall be immediately backfilled with well-compacted material.
- F. Sheeting Left In Place
 - 1. To prevent subsequent damage to structures or property, it may be necessary to leave sheeting, bracing, etc. in place to be embedded in backfill or concrete.
 - 2. Materials used for sheeting and bracing may have to be cut off at any specified elevation due to job conditions.

3.04 DRAINAGE

- A. The CONTRACTOR shall provide, place and maintain ample means and devices with which to remove promptly and dispose properly of all water entering trenches and other excavations, or water that may flow along or across the site of the work and keep said excavations dry until the structures, pipes, and such appurtenances to be built therein have been completed to such extent that they will not be damaged.

3.05 PROTECTION OF EXISTING UTILITY LINES

- A. As the excavation approaches pipes, conduits, or other underground structures, digging by conventional trenching machine methods shall be done with extreme care. Manual excavation may be required to locate utilities and/or underground structures.
- B. All existing pipes, wires, fences, curbs, property-line markers, and other structures which in the opinion of the ENGINEER must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage, and in case of damage, the CONTRACTOR shall notify the "property owner" so that proper steps may be taken to repair any and all damage done. When the "property owner" does not wish to make the repairs themselves, all damage shall be repaired by the CONTRACTOR or, if not promptly done by him, the ENGINEER may have the repairs made at the expense of the CONTRACTOR.
- C. All utility services shall be supported by suitable means so that the services do not fail when tamping and settling occurs.

3.06 RELOCATION AND REPLACEMENT OF EXISTING UTILITY LINES

- A. If in the course of construction, the CONTRACTOR encounters utility services of any kind which encroach upon or are encountered near and substantially parallel to the edge of the excavation and in the opinion of the ENGINEER will impede progress to such an extent that satisfactory construction cannot proceed, they shall be changed in location, removed (later be restored), or replaced.
- B. In removing existing pipes, the CONTRACTOR shall use care to avoid damage to material.
- C. When fences interfere with the CONTRACTOR's operations, he shall remove and (unless otherwise specified) later restore them to at least as good condition as that in which they were found immediately before the work was begun. The restoration of fences shall be done as promptly as possible and not left until the end of the construction period.

3.07 SUBGRADE PREPARATION

- A. If, in the opinion of the ENGINEER, the materials at or below the elevations shown on the plans are unsuitable for support of structures or piping, it shall be removed to such depth and width as the ENGINEER may direct. Such extra excavation shall be placed with Class D Concrete or Type 2A Modified Stone as directed by the ENGINEER. Such changes shall be authorized in writing. All surplus excavated materials shall be removed from the site.
- B. Residual soil or decomposed rock subgrade areas which are located beneath or very close to the groundwater level shall be immediately covered with a granular working mat to prevent softening of the natural soil material due to subsequent construction activities or by exposure to the elements. The granular working mat shall have a minimum thickness of 6 inches and shall consist of select fill. The material shall be compacted on-grade using manually guided compaction equipment.

3.08 DEEP EXCAVATIONS

- A. The sides of the excavation up to a height of two (2') feet from the bottom of the trench shall be kept as nearly vertical as possible, consistent with the type of material encountered. Above this height, the CONTRACTOR shall slope or bench the trench walls or provide temporary sheeting to maintain safe working conditions for the workpersons and traffic. A clear area shall be maintained to avoid overloading which may cause slides, cave-ins or shifting of the pipes. All damages to pipe or structures occurring due to settlement, heaving, water or earth pressure, slides or other causes shall be repaired or replaced by the CONTRACTOR at his own expense.

It is the responsibility of the CONTRACTOR and his superintendent to ensure that all the work is performed in accordance with O.S.H.A. and Pennsylvania Occupational Safety Laws requirements.

3.09 GROUNDWATER CONTROL

- A. Installation of sewers and structures below the groundwater table will require a temporary dewatering system if water is observed to seep into the excavation through the sidewalls or bottom. If required, this system shall consist of sump pits or trenches located around the perimeter of the excavation. Pumping from the sump pits for trenches shall continue until the water level is at least one to two feet below the bottom of the excavation, and the excavation bottom is observed to be dry and stable. The water table must be maintained below this grade until the pipe or structure has been placed, the peripheral excavation backfilled, and sufficient load provided to resist hydrostatic uplift.

3.10 EARTHWORK FOR SEWERS

A. Trench Width

1. The trench width shall be such as to provide sufficient working space on each side of the pipe for proper laying, but shall not be less than:

<u>Nominal Diameter of Pipe In Inches</u>	<u>Minimum Trench Width In Inches</u>	<u>Maximum Trench Width In Inches</u>
Up to 20	O.D. + 12	O.D. + 24
20 and Over	O.D. + 16	O.D. + 28

2. The trenches shall be sufficiently straight between the designated points to permit the laying of pipe approximately in the center of the trench. The width of the trench for sheeting and shoring shall be measured between the closest interior faces of sheeting. The width of the trench at and below the top of pipe shall be wide enough to permit workmen and the ENGINEER free access for inspection.
3. If the CONTRACTOR excavates the trench more than the above width requirements, for any reason, he shall at his own expense encase or cradle the pipe in a manner satisfactory to the ENGINEER.

B. Excavation Below Grade

1. The CONTRACTOR shall excavate all trenches to at least six (6") inches below the pipe barrel to the proper profile shown on the Contract Drawings. The CONTRACTOR shall avoid over-excavation and provide a uniformly graded bottom surface. All loose material shall be removed from the trench. The bedding, pipe installation and backfilling shall then be accomplished as specified.
2. Where the bottom of the trench, by mistake of the CONTRACTOR, is taken out to a greater depth than specified for a given pipe bedding, the trench shall be brought back to grade as follows:
 - a. The over-excavation shall be filled with crushed stone so as to comply with the requirements for crushed stone foundation.
3. Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.
4. This additional material required due to the over-excavation shall be furnished and installed by the CONTRACTOR at his own expense.

C. Trench Length

1. The length of trench to be opened in advance shall depend upon the CONTRACTOR's ability to complete the installation of pipe and backfilling of the trenches at the end of the day. In no case shall the trench be opened more than 100 feet in advance of the pipe lines laid. Where the rock excavation is encountered, the ENGINEER may limit the length of trench to lesser than 100 feet to protect the pipes already installed.
2. All trenches shall be backfilled at the end of each day. Wherever necessary, trenches shall be covered with steel plate, properly anchored, adequately barricaded and provided with safety lights. All open ends of the pipes installed shall be adequately protected overnight from moisture and foreign materials. All such work shall be considered incidental to the construction of the pipe.

D. Pipe Bedding

1. General

- a. Take care to avoid contact between the pipe and compaction equipment. The tampers shall be hand or pneumatic of the proper size to operate between trench wall and pipe.
- b. Do not use compaction equipment directly over the pipe while placing the pipe bedding to insure that such equipment will not damage or disturb the pipe.
- c. Pipe bedding shall, in all cases, extend up until one (1') foot of cover has been built up over the pipe.
- d. Refer to Drawings at the end of these specifications for bedding details.
- e. The bedding shall be compacted to not less than 95% of the maximum dry density as determined by ASTM D1557.

2. Crushed Stone Bedding (Encasement)

- a. All pipe shall be installed in a crushed stone encasement that is 6" below and 12" atop the pipe. The crushed stone shall be placed in the trench for its full width to uniformly support the pipe at the required line and grade.
- b. Encasement material shall be spread in 4-inch layers and each layer shall be compacted with tampers until the required total depth of bedding (encasement) has been built up.

3. Concrete Encasement

- a. Where specified or required in the field, the pipe shall be supported by Concrete Encasement.
- b. The trench shall be excavated to a minimum depth as shown on the Plans. The excavated space shall then be completely filled with, and the entire pipe encased in concrete such that the concrete encasement measures a minimum 6 inches above the top of the pipe. The total minimum width of the concrete encasement shall equal the width of trench excavation. Unless otherwise shown on the Plans or specified herein, concrete shall be as specified herein. Freshly poured concrete shall be maintained free from ground water for at least the first four hours. No backfilling of the trench shall begin until a minimum time period of 24 hours has elapsed after the encasement has been poured. Steel reinforcing, if required shall be as shown on the Plans.

4. Concrete Cradle

- a. Where unstable conditions are encountered, the pipe shall be supported on Concrete Cradle. Concrete cradles shall be installed where no suitable supporting soil or rock stratum exists within two feet of the bottom of the pipe.
- b. The concrete cradle shall be furnished and installed equal to the "Concrete Encasement," except that only that portion of the encasement at and below the horizontal diameter of the pipe shall be poured, forming a true cradle under the bottom half of the pipe.
- c. The balance of the bedding to one (1') foot above the pipe shall be crushed stone.

E. Crushed Stone Foundation

1. In all bedding conditions where a suitable supporting soil or rock stratum occurs at a depth greater than required on the Plans but less than two (2') feet below the pipe or where moderately unstable soil conditions are encountered or where the trench is excavated below the specified depth or where required by the ENGINEER, the foundation shall be modified as follows:
 - a. Except in the case of over-excavation where no extra excavation will be required, the trench shall be excavated to the depth necessary to reach the suitable supporting stratum. Crushed stone shall be spread in 4-inch layers, and each layer shall be compacted with 20-pound hand or pneumatic tampers.

- e. Any damage caused to properties due to sewage handling and/or sewage backup while testing shall be the responsibility of the CONTRACTOR.

2. Testing equipment:

a. Air Testing:

- 1) Air testing shall be performed utilizing testing equipment consisting of an air-compressor and storage tank of adequate capacity; an air control panel equipped with all necessary piping, valves and pressure gages to control the rate at which the air flows to the test section and to monitor the air pressure inside the test section; and all required plugs. In order to prevent overloading the test section with the full pressure of the compressor, the test equipment must be provided with an approved pressure relief device set to blow out at 10 psi. An extra pressure gage of known accuracy shall also be provided so that the gages of the test equipment can be frequently checked. The air testing equipment and all accessories shall be subject to the approval of the ENGINEER.

b. Infiltration Test:

- 1) Infiltration tests will be acceptable only when the ground water can be established as imposing a minimum six (6) foot head at the pipe invert.
- 2) Plug the upstream manhole and make a measurement of the downstream flow with a portable V-notch weir. A flow stabilization period of 20 minutes is required. The amount of leakage from any section of the sewer shall not exceed the allowable gallonage as stated per inch diameter of pipe per mile per 24 hours.

c. Exfiltration Test:

- 1) Exfiltration tests will be acceptable only when a minimum interval head of six (6) feet of water can be maintained above the invert of the pipe.
- 2) The leakage limit shall not exceed the leakage allowance as stated per inch diameter per mile per 24 hours. The tests must be performed for a 24-hour period during which time volumetric make-up quantities will be tabulated.

- d. Deflection Testing:
 - 1) Deflection testing shall be performed using a rigid "Go-No Go" device. A hydro-cleaner or blower/parachute device, complete with string lines, shall be provided for attaching pull lines.
- 3. Cleaning:
 - a. No debris, silt, or other material shall enter existing sewers. It shall be the responsibility of the CONTRACTOR to have the pipe clean at the time of air testing and deflection testing. If required, the pipe shall be cleaned by hydro-flushing with water or by passing through the pipe a full gauge squeegee in a manner approved by the ENGINEER.
- 4. Air Testing Procedure:
 - a. All wyes, tees, or end of side sewer stubs placed for future connections shall be plugged with flexible-joint caps, or acceptable alternate, securely fastened to withstand the internal test pressure. Plugs or caps shall be readily removable.
 - b. Immediately following the pipe cleaning, the pipe installation between each reach of the plugged lateral connections shall be tested with low pressure air. The ENGINEER shall specify the duration permitted for a prescribed low pressure air exfiltration pressure drop between two consecutive manholes. The prescribed drop shall not exceed 0.5 psi from 5.0 to 4.5 psi, in excess of the groundwater pressure above the top of the sewer. At least two minutes shall be allowed for temperature stabilization, adding only the amount of air required to maintain pressure.
 - c. The pipe shall hold the required test pressure for the duration prescribed in the Air Test Table (Table 1) attached to this section.
 - d. Repair and retest sections of sewer not meeting test requirements.
- 5. Infiltration or Exfiltration Tests:
 - a. Maximum allowable leakage for either infiltration or exfiltration shall be 50 gal/inch - diameter mile/24 hours.

6. Deflection Testing Procedure:

- a. Deflection testing is not considered standard test requirements. It will only be used under special circumstances when directed by the ENGINEER.
- b. Use Go-No-Go device in accordance with pipe manufacturer's requirements. Method to be approved by the ENGINEER prior to testing.
- c. Unless specified otherwise by the ENGINEER, long term pipe deflection (reduction in vertical inside diameter) should not exceed 5%. Recommended mandrel dimensions based on 5% deflection, are as shown below:

<u>Pipe Dia. In.</u>	<u>Mandrel O.O. In.</u>
8	7.37
10	9.23
12	10.98
15	13.44
18	16.15
21	19.02
24	21.43
27	24.10

- d. Repair and retest sections of sewer not meeting test requirements.

D. Manhole Acceptance Tests:

1. General:

- a. After the manhole has been completely constructed, the frame bolted thereon, and the trench backfilled, a "Manhole Acceptance Test" shall be performed using the vacuum test.
- b. Any damage caused to properties due to sewage handling and/or backup while testing shall be the responsibility of the CONTRACTOR.

2. Vacuum Test Procedures:

- a. The testing shall be done after assembly of the manhole.
- b. All lift holes shall be plugged with a non-shrinking mortar, as approved by the ENGINEER.

- c. The seal between the manhole sections shall be in accordance with ASTM C923.
- d. The CONTRACTOR shall plug the pipe openings, taking care to securely brace the plugs and the pipe.
- e. With the vacuum tester set in place:
 - 1) Inflate the compression band to effect a seal between the vacuum base and the structure.
 - 2) Connect the vacuum pump to the outlet port with the valve open.
 - 3) Draw a vacuum to 10" of Hg. and close the valve.
- f. The test shall pass if the vacuum remains at 10" Hg. or drops to 9" Hg. in a time specified for the particular size manholes listed.

VACUUM TEST TABLE

<u>Manhole Diameter</u>	<u>Test Period</u>
48"	60 sec.
60"	75 sec.
72"	90 sec.

If the manhole fails the initial test, the CONTRACTOR shall locate the leak and make proper repairs. Testing shall continue until the manhole passes the aforementioned criteria.

- g. Testing of manholes by the CONTRACTOR shall be performed in the presence of the AUTHORITY's representative.

E. Minimum Testing Requirements:

- 1. The CONTRACTOR shall take care to securely fasten and brace all line plugs in the pipe section being tested so that none of the plugs is suddenly released when the compressed air is applied to the pipe section. The CONTRACTOR shall limit the internal pressure in the sewer line to 5 psi greater than the average back pressure of any ground water that may submerge the pipe.
- 2. The CONTRACTOR shall be responsible for any damages caused by the internal pressurizing of the sewer line.

3. All gages, air piping manifolds and valves of the air testing equipment shall be located above ground at the top of the trench.
4. No one shall be allowed in the manholes during testing.
5. Special care shall be exercised during removal of plugs; and the pressure in the piping of the test section shall be completely relieved before any plug shall be removed.

F. Force Main Testing

1. All force mains shall be hydrostatically tested in conformance with the requirements of AWWA C 600-93.
2. Pressure Tests
 - a. All force mains shall be tested by the CONTRACTOR at a pressure of 50 psi in excess of normal pump discharge pressure or a minimum of 75 psi whichever is greater and approved by the ENGINEER before acceptance. All equipment required for testing shall be furnished by the CONTRACTOR. Any leaks which develop as a result of the pressure test shall be repaired by the CONTRACTOR and pipes then retested. All defects revealed by the tests shall be made good with new material. Tests and repairs shall be continued until all test requirements have been met.
 - b. All testing of piping systems shall be completed prior to insulating and/or painting.
 - c. After the pipe is laid, the joints completed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for one hour to a pressure test of the intensity specified above. Each valve shall be opened and closed several time during the test. Exposed pipe, joints, fittings and valves shall be carefully examined during the open-trench test. Joints showing visible leakage shall be replaced or remade as necessary. Leaking rubber-gasketed joints shall be remade, using new gaskets if necessary. Cracked or defective pipe, mechanical joints, fittings or valves discovered in consequence of this pressure test shall be removed immediately and replaced with sound material, and the test shall be repeated with sound material, and the test shall be repeated until the test results are satisfactory.

3. Leakage Tests

- a. A leakage test for force mains shall be conducted after the pressure test has been satisfactorily completed. The duration of each leakage test shall be at least two hours, and during the test the pipe shall be subjected to a 150 percent of the pump discharge pressure or a minimum of 75 psi whichever is greater. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{SDP^{\frac{1}{2}}}{133,200}$$

in which L equals the allowable leakage in gallons per hour; S is the length of pipeline tested; D is the normal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gage. Should any test of pipe laid disclose leakage greater than that specified above, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the AUTHORITY.

1.03 SUBMITTALS

- A. Submit shop drawings or catalog cuts, as appropriate, for materials listed under Article 2.01 of this Section. Submit only those materials that are actually to be used in the work. These will usually be as follows:
1. PVC & Ductile Iron Pipe & Fittings
 2. Precast Concrete Manholes.
 3. Manhole Steps.
 4. Manhole Castings.
 5. Gaskets, Adapters, Pipe Couplings, Sealing Compounds, and Other Appurtenances.
- B. Make submittals prior to start of construction. Make submittals to the ENGINEER.

1.04 DELIVER, STORAGE, AND HANDLING

- A. Deliver, store and handle the piping, manholes, manhole frames and covers and appurtenances in accordance with the manufacturer's recommendations, and in such manner as to protect the materials from damage.
- B. Pipe and related materials shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such material be dropped or skidded against pipe already on the ground.
- C. Pipe and related materials shall at all times be handled with care to avoid damage. The interior shall be kept free from dirt and foreign matter. All pipe, manholes, manhole frames and covers and appurtenances shall be carefully lowered or raised into place with suitable equipment in a manner that will prevent damage to the material. Under no circumstances shall pipe or accessories be dropped or dumped.
- D. Manholes, and all related materials, shall be thoroughly inspected for defects prior to their being installed. Any defective, damaged, or unsound material, as determined by the ENGINEER, shall be repaired or replaced as directed.
- E. All lumps, blisters, and excess coating shall be removed from the ends of each pipe. The joints shall be wire brushed and wiped clean, dry and free from oil and grease before the pipe is installed.

ARTICLE 2 - PRODUCTS

2.01 MATERIALS

A. General

- 1. All gravity sewer mains and laterals 15" and smaller shall be either Class 52 ductile iron pipe or ASTM D-3034 SDR 26 Type PSM PVC pipe as approved by the ENGINEER.
- 2. All gravity sewer mains 18" to 27" diameter shall be ASTM F 679 (wall thickness T-1) or class 52 ductile iron pipe, unless approved other wise by the ENGINEER.
- 3. All sewage force mains 4" to 12" in size shall be either Class 53 ductile iron pipe or SDR 18 PVC pipe as approved by the ENGINEER.
- 4. For new construction, all lateral connections to the sewer main shall be made by means of a wye and a 45° elbow. The use of a tee or tee/wye fitting is not acceptable.

5. Class 52 Ductile Iron Pipe shall be used from manhole to manhole for any sewer run that has a depth of cover exceeding fifteen feet (15') for any portion of piping in that run and for sewers placed in fills.
6. The minimum lateral pipe size from the main to the property line shall be six (6) inches in size when a new sewer main is being installed. When the sewer main is existing and a saddle is required, then the lateral shall be four (4) inches in size for an eight (8) inch main and six (6) inches in size for a main larger than eight (8) inches.
7. The building sewer from the lateral to the building shall be ASTM D-2241 SDR 26/PR160 Type PSM PVC pipe or ASTM 1785 Schedule 40 PVC pipe for 4 inch diameter.

B. Ductile Iron Pipe and Fittings.

1. Pipe

- a. Ductile iron pipe shall be centrifugally cast, annealed ductile iron manufactured in accordance with ANSI A21.51.
- b. Pipe joints shall be push-on or mechanical joint and shall conform to ANSI specification A21.11. Furnish joints with all required accessories.
- c. Ductile iron pipe shall be made of ductile iron of good quality and of such character as shall make the metal castings strong, tough and of even grain and soft enough to satisfactorily permit drilling, tapping, and cutting. All piping shall be smooth, free from scale, lumps, blisters, and sand holes and defects of every nature which make it unfit for the use intended. All piping shall be straight and shall be true circles in section with its inner and outer surfaces concentric. Piping shall be subject to inspection and approval by the ENGINEER upon delivery, and no broken, cracked, misshapen, or other wise damaged or unsatisfactorily piping will be accepted.
- d. Each piece of pressure ductile iron pipe shall have the weight and class designation conspicuously painted on it as near as possible to the flange or bell end of the pipe and these designations shall be clearly legible.

2. Fittings.

- a. Furnish fittings in accordance with ANSI 21.10 350 psi rating.

- b. Joints shall be mechanical joint in accordance with ANSI A21.11. Furnish joints with all required accessories.
 - d. Ductile iron compact fittings meeting ANSI A21.53 requirements shall not be used.
 - d. Where restrained joints are required, use EBAA Iron, INC Megalug or equal glands.
 - 3. Cement and Mortar Lining.
 - a. Cement and mortar line all pipe and fittings in accordance with ANSI A21.4.
 - b. Lining Thickness: 1/8 inch minimum.
 - c. Tolerance: plus 1-8 inch.
 - d. Paint seal coat in accordance with ANSI A21.4.
 - 4. Tar Coat exterior of ductile iron pipe and fittings.
 - 5. Furnish gaskets in accordance with ANSI A21.11.
- C. PVC Pipe
- 1. Gravity Sewer Pipe and Fittings
 - a. Pipe 4" and smaller: ASTM D-2241, SDR 26/PR 160 or SDR 21 (min.), Type PSM PVC.
 - b. Pipe 6" to 15" diameter: ASTM D-3034, SDR 26 (min.), Type PSM PVC.
 - c. Pipe 18" to 27" diameter: ASTM F679 (Wall Thickness T-1).
 - d. Flexible Elastomeric Seals: ASTM 3212
Seal Material: ASTM F477
 - 2. Pressure Pipe and Fittings (4" and Greater)
 - a. Outside Diameter Dimension Pipe: AWWA C900
Pressure Class 150 and conform to the requirements of DR 18.
 - b. Fittings: PVC Fittings, Pressure Class 150 and conform to the requirements of DR 18

3. Pressure Pipe and Fittings (3" and Smaller)

- a. Pipe: ASTM D2241 (SDR 26 - Class 160)
- b. Gaskets: ASTM F477
- c. Fittings: Pressure Class 160 conforming to Requirements of SDR 26.

D. Steel Casing Pipe

1. Smooth steel wall casing pipe conforming to ASTM A-252 Grade 2, minimum plate thickness ½ inch.
2. Pipe to be coated with coal tar epoxy as manufactured by Koppers, or equal. Apply coating in accordance with coating manufacturer's recommendation.
3. Submit manufacturer's certification.

E. Pipe Couplings and Adapters

1. Pipe couplings used to join plain end pipe of like outside diameters shall be Ford Style FC1 cast coupling with stainless steel nuts and bolts. An alternate coupling shall be Ford Style FS1 or FS2 stainless steel repair clamp or SDR 26 PVC couplings, as manufactured by Harco or approved equal.
2. Pipe couplings used to join plain pipe of unlike outside diameters shall be Ford Style FC1 cast coupling with stainless steel nuts and bolts. An alternate coupling will be permitted if the Ford coupling is not suitable for use on either pipe O.D. The exact O.D. of both pipes must be known prior to the coupling being ordered.

F. Tee Saddles

1. When approved by the ENGINEER, a tee saddle may be used to connect a new lateral to an existing main.
2. The required hole in the sewer main shall equal the inside diameter of the lateral and shall be only made by core drilling. The maximum size holes allowed are 4" in an 8" sewer main, and 6" in a 10" sewer. If a 6" connection is required to be made in an 8" sewer main, then a wye or tee fitting must be inserted in the sewer main using the coupling specified in paragraph 2.01E to join the piping.

3. Core drilling of the hole and installation of the saddles shall be done in the presence of the Township's representative.
4. Body of Saddle to be of cast grey iron coated with a rust inhibitor paint and correctly contoured for the size and kind of pipe on which it is to be installed.
5. The Saddle to contain an ASTM C-361-77, or equal, Rubber Tubular O-Ring Gasket cemented in place.
6. The Saddle shall have an integral SDR 26 PVC spigot provided for connection to the lateral.
7. A fabricated stainless steel strap, of at least 24 gage x 2.5" wide and containing two 0.375" stainless steel T-Bolts and Nuts, is to be supplied for clamping the Saddle to the pipe.
8. The Saddle with gasket shall withstand at least 7 p.s.i. internal pressure when installed.
9. The Saddle shall be Geneco Model 90H Sealtite Type DF or approved equal.

G. Manholes

1. **Precast Concrete Manhole Bases**
 - a. Precast concrete bases shall be of the design and dimensions shown on the Detail Drawings. Precast concrete bases shall be manufactured by the wet cast process. The placing of concrete and steam curing of the precast concrete base shall be performed in accordance with the requirements specified in Section 3.6.11 and Section 3.7.2 respectively of A.W.W.A Standard C302 for Reinforced-Concrete Water Pipe-Noncylinder Type, Not Prestressed.
 - b. Concrete used in the manufacture of precast bases shall have a minimum compressive strength of 4000 pounds per square inch at 28 days and the cement used in the concrete shall be Type II portland cement conforming to A.S.T.M. Specification Designation C150.
 - c. Openings in precast bases to accommodate the connection of the sewer piping shall be custom preformed for each manhole base at the time of manufacture of the bases at the manufacturer's plant. Openings for connection of sewer piping shall be of the size and shape required for the particular type of pipe seal provided.

- d. The tops of the precast bases shall be accurately formed to receive the tongue of the bottom precast concrete manhole section of the wall.
- e. The vertical wall section shall extend at least six (6) inches above the top of the highest inflowing sewer pipe joining the manhole section.
- f. A minimum of four (4) inch clearance shall be provided between the floor of the precast base and invert of the lowest outflowing sewer pipe to provide for the construction of formed invert and bench wall within the manhole. Only two (2) lift inserts shall be permitted for the cast in bases. Thickness of the bottom slab shall be a minimum of eight (8) inches for manholes up to twelve (12) feet in depth. Thicker bottom slabs may be required for manholes greater than twelve (12) foot depths.

2. **Monolithic Poured-In-Place Concrete Manhole Bases**

- a. The use of poured-in-place concrete bases can only be used in special cases and must be approved in writing by the ENGINEER.
 - b. Monolithic poured-in-place concrete bases shall be of the design and dimensions indicated on the Detail Drawings.
 - c. Consistency: The mixed concrete shall be of uniform consistency. The maximum allowable slump shall be 2 inches.
 - 1) This strength requirement shall be verified by tests. At least one test shall be made per day or one test structure. A test shall consist of at least two cylinders whose 28-day compressive strengths shall be determined by an approved laboratory. The cylinders shall be made by the CONTRACTOR subject to the inspection of the Inspector.
 - 2) Fill concrete shall be 2500 psi, that is required as backfill for over-excavated foundations, for foundation voids or cavities, pipe encasements, or reaction backings, shall have an average compressive strength of 2500 psi at 28 days and a 3 inch maximum slump.
3. Concrete used for channels inside precast manhole bases shall be of a 2500 psi Mix Design with a 5/8" diameter maximum allowable aggregate size.

- a. Consistency: The mixed concrete shall be of uniform consistency. The maximum allowable slump shall be 1 inch.
4. Precast Reinforced Concrete Manhole Riser and Top Sections
- a. Walls of manholes shall be constructed of precast reinforced concrete manhole sections. Except as otherwise specified herein, the riser and top sections shall be manufactured in compliance with the requirements of ASTM C478 for Precast Reinforced Concrete Manhole Sections.
 - b. The riser sections and conical top sections shall be manufactured by the wet cast process. The placing of concrete and the steam curing thereof shall be performed in accordance with the requirements specified in Section 3.6.11 and Section 3.7.2 respectively of A.W.W.A. Standard C302 for Reinforced-Concrete Water Pipe-Noncylinder Type.
 - c. Concrete used in the manufacture of precast manhole riser and top sections and precast grade rings shall conform to the requirements specified in ASTM C478, and the cement used in the concrete shall be Type II portland cement conforming to ASTM C150.
 - d. Riser section joint shall be of the ship lap type with an equivalent lap of three (3) inches and a minimum wall thickness as shown on the Detail Drawings. Top sections shall be of eccentric cone or flat slab top design as required. Eccentric cone top sections shall have the same minimum wall thickness and area of circumferential steel reinforcement as the round riser sections. Flat slab tops shall have a minimum thickness as shown on the Detail Drawing and shall be reinforced with steel in accordance with the design requirements specified in ASTM C478. Top sections shall have a straight side cone section with a minimum opening at 24 inches, and shall have a top width of such design and dimensions as to properly support the required manhole frame and cover. The lower joint shall be the ship lap type with an equivalent lap of three (3) inches.

5. Steel Reinforcement

- a. Steel reinforcement used in the manufacture of precast concrete manhole bases and precast concrete riser and top sections shall conform to the requirements specified in Section 6 of ASTM C478.

6. Gasket for Sealing Precast Concrete Manhole Joints

- a. Manhole section joint gasket materials specified herein shall be used in accordance with the Detail Drawings. Only one method of joint sealing and gasketing (e.g., preformed plastic gaskets and non-shrink cement grout) will be permitted for all manholes, unless otherwise directed by the ENGINEER.

1) Preformed Plastic Gaskets for Manhole Joints

- a) Flexible plastic gasket-type sealant for manhole joints shall be "RUB'R-NEK" as manufactured by K.T. Snyder Company, Inc., of Houston, Texas, or approved equal, as directed by the ENGINEER. Butyl rubber (plastic) sealant shall meet the requirements of Federal Specification SS-S-210A (3.4 Adhesion & Hydrostatic Pressure) and shall conform with the applicable requirements specified in Section 5.7 of ASTM C361.
- b) The sealing compound shall not leak at the joints (while being tested at 10 psi) for a period of 24 hours. Requirements for sag and flow resistance (vertical and overhead 1" wide joints) shall be such that no sagging is detected (while being tested at 135 degrees F) for a period of 5 days. Requirements for chemical resistance shall be such that no visible deterioration of the sealing compound occurs (when immersed separately in a solution of acid, alkalis and saturated hydrogen sulfide) for a period of 30 days.
- c) The sealing compound shall be supplied in extruded rope form of suitable cross-section. The size of the sealing compound

shall be in accordance with the manufacturer's recommendations and sufficient to obtain squeeze-out of the material around the entire interior and exterior circumference when the joint is completed. The sealing compound shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half to facilitate application of the sealing compound. The sealing compound contained within the joint shall be the sole element utilized in sealing the joint from internal and external hydrostatic pressure. Joint surfaces shall be primed, sealing compound applied, and joint made in strict conformance with the written specifications of the sealing compound manufacturer.

2) Rubber O-Ring Gaskets for Manhole Joints

- a) For joints sealed with rubber gaskets, the joint design and rubber gaskets shall conform with the applicable requirements specified in ASTM C443 and in Section 5.7 and Section 4.10 respectively of ASTM C361. A rectangular groove shall be provided in the tongue end of each manhole section to receive the rubber gasket and to contain the deformed gasket on all four sides when the joint is completed.

7. Rubber Manhole Pipe Gaskets

- a. All manhole pipe gaskets shall be integrally cast in the manhole wall and properly sized for the outside diameter of the pipe being used. Gaskets shall be all-rubber composition, flexible, pliable, and provide up to 15 degrees lateral, diagonal or vertical pipe deflection. Gaskets shall be leak-proof tested to 20 psi, and shall meet or exceed rubber quality standards of ASTM C443 and Test Performance Requirements ASTM C425 for compression joints.

- b. Gaskets shall be A-LOK as manufactured by A-LOK Products Corp. or Star Seal as manufactured by Galaxy Sales Co.
- c. In the event a hole has to be made into an existing manhole to receive a pipe, the hole shall be made only by core drilling. The annular space between the pipe and manhole wall shall be sealed with a modular type seal as manufactured by Thunderline Corp. The seal shall consist of interlocking synthetic rubber links, two (2) pressure plates and stainless steel nuts and bolts.

8. Manhole Drop Connections

- a. Pipe and fittings used for making drop connections shall be of the same type as the pipe and fittings used to construct the sewer line from which the drop connection is made, unless approved otherwise.
- b. Inside drops shall be used unless approved otherwise. The minimum manhole size for an inside drop connection shall be five (5) feet inside diameter.

9. Manhole Steps

- a. Manhole steps shall be of aluminum as made by Alcoa Aluminum Company, No. 15785 alloy 6061-16, tensile 38,000 p.s.i., yield 35,000 p.s.i., or approved equal. Manhole steps shall be installed in the reinforced concrete walls of the riser and eccentric top sections.
- b. Field installation of manhole steps shall not be permitted. Steps shall be aligned vertically and spaced so as to be on equal centers in the assembled manhole, a maximum distance apart 12 inches. Steps shall be located the minimum distance from the ends of riser and top sections as shown on the Detail Drawing. Each step shall be embedded in the riser section at least three and one-half (3 ½) inches but not more than four (4) inches.
- c. The pewtor of the step cast in the concrete shall be coated with bituminous coating prior to casting.
- d. Plastic-coated, deformed reinforcing bar encapsulated with injection molded propylene shall be an acceptable alternate. The step shall be provided with a separate tread and end lugs to prevent feet from slipping off.

10. Manhole Castings

- a. Castings for manhole frames, and covers, shall be heavy duty cast iron and designed for HS-20 loading.
- b. Ferrous Castings shall be of uniform quality, free of blow holes, shrinkage distortion, or other defects.
- c. Metal shall conform to ASTM A-48 Class 35 gray iron.
- d. All castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Frames and covers shall have continuously machined bearing surfaces to prevent rocking.
- e. As-cast dimensions may vary one half the maximum shrinkage characteristic of the metal or $\pm 1/16$ inch.
- f. All castings shall be cleaned by means of sand blast, neatly finished, and have one coat of black asphaltum paint applied at the factory.
- g. The wording "Sanitary Sewer" shall be cast appropriately on each cover. Lettering shall be a minimum of 2" high.
- h. Manhole Casting Schedule
 - 1) Standard Manhole frame and cover.
 - a) Total weight, 400 pounds minimum.
 - b) Provide a minimum clear entrance opening of 24".
 - c) Two concealed pick holes shall be provided.
 - d) Provide machined dovetail groove centered in lip seat of cover for $\frac{1}{4}$ inch diameter continuous loop polyisoprene or neoprene rubber gasket (40 durometer).
 - e) Drill four $\frac{7}{8}$ inch diameter holes in frame flange equally spaced.

2. Watertight Manhole Frame and Cover.

- a) Total weight 410 pounds minimum.
 - b) Two concealed pick holes shall be provided.
 - c) The frame lip shall be provided with a machined dovetail groove for a self sealing ¼ inch diameter continuous loop polyisoprene gasket (40 durometer).
 - d) Provide four (4) stainless steel bolts to provide a continuous tight seal between the frame and cover. Extend lid of frame as required in order to provide tapped holes.
- 3) Drill four 7/8 inch diameter holes in frame flange.

i. Manholes, frames, and covers shall be as shown on the Detail Drawings.

j. Manufacturer

- 1) Washington Street Brass & Iron Foundry.
- 2) E.A. Quirin Machine Shop.

11. Precast Concrete Manhole Grade Rings

- a. Precast concrete manhole grade rings for leveling units shall be manufactured in compliance with the requirements of the Specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C478; and shall be as thick as necessary to provide the required grade adjustment. Each grade ring shall have four holes cast therein at the manufacturer's plant for the manhole frame hold down bolts. Broken or cracked concrete grade rings will not be acceptable. Grade adjustment for a manhole shall not exceed nine (9) inches.

12. Leveling Brick

- a. Brick generally will not be permitted for grade adjustment unless conditions prevent the use of precast concrete grade rings as determined by the ENGINEER.

- b. Bricks shall be made of clay or shale, and none but whole, sound, burnt hard entirely through, straight brick, uniform in structure, with true, even faces, free from stones, pebbles, masses on line, cracks, and checks extending into the body of the bricks, shall be used. The brick shall be new, whole smooth brick of uniform standard commercial size with straight parallel edges and square corners. The sides and ends of brick shall be plane surfaces at right angles and parallel one to the other.
- c. When struck with a trowel, bricks shall give a clear ringing sound; and a fracture shall show uniform and compact structures.
- d. The brick shall comply with ASTM Specification C-32, Grade MA or as specified.
- e. If deemed necessary by the ENGINEER, the brick shall be culled and the truest brick shall be used.

13. Cement Grout

- a. Grout shall be non-shrink or water plug grout.

14. Protective Coatings

- a. General

- 1) All interior and exterior epoxy coatings shall be factory-applied by the manhole manufacturer. Prior to applying the coatings, all concrete surfaces shall be blown free of all dirt and debris and brushed clean.

- b. Exterior

- 1) The coating shall be Bitumastic Super Service Black as manufactured by Koppers Co., Inc. equivalent of Mobil Chemical Co., or equal. At least two (2) coats shall be applied giving a total dry film thickness of a minimum of 24.0 mils. After installation, damaged surfaces shall be recoated in accordance with the coating manufacturer's recommendation to give the required 24 mils dry film thickness.

- 2) As an alternate, the coating shall include 2 coats of epoxy-amine adduct, multi-mill, two component, catalyzed epoxy, with total solids volume of 49-51%, which is resistant to alkali, salt and ground water immersion, petroleum products and acids. Coating shall meet AWWA D102-78, paint system No. 1 standards and a minimum 12 mils dry film thickness.

c. Interior

- 1) The coating shall include 2 coats of epoxy-amine adduct, multi-mill, two component, catalyzed epoxy, with total solids volume of 49 - 51%, which is resistant to alkali, salt and ground water immersion, petroleum products and acids. Coating shall meet AWWA D102-78, paint system No. 1 standards and a minimum 12 mils dry film thickness.
- 2) In areas where the potential for severe corrosion problems may occur, the use of "DURA Plate 100" interior PVC liner may be required by the ENGINEER.

ARTICLE 3 - EXECUTION

3.01 LAYING PIPE

A. General

1. Following trench excavation, pipe laying shall proceed upgrade with pipe laid carefully, hubs upgrade, spigot ends fully centered into adjacent hubs, and true to lines and grades given.
2. Each section of pipe shall rest upon the pipe bed for the full length of its barrel, with recesses excavated to accommodate bells and joints. Each pipe shall be firmly held in position so that the invert forms a continuous grade with the invert of the pipe previously placed.
 - a. Utilize portable laser to establish grades of sewers, laser shall be used in accordance with manufacturer's written instructions.
 - 1) Grade shown on Drawings is that of Sewer invert. Tolerance $\pm \frac{1}{4}$ inch.

3. Under no conditions shall pipe be laid in water, on subgrade containing frost, and/or when trench conditions are unsuitable for such work. In all cases, water shall be kept out of the trench until concrete cradles, supports, encasement, or saddles, where used, and materials in the joints have hardened.
4. Any pipe that has its grade or joint disturbed after laying shall be taken up and relaid. Any section of pipe already laid and found to be defective shall be taken up and replaced with new pipe.
5. Walking or working on top of the completed pipeline, except as may be necessary in backfilling or tamping, shall not be permitted until the trench has been backfilled to a height of at least 2 feet over the top of the pipeline.
6. Maintain pipelines free and clear of debris during the progress of the work.
7. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by watertight plugs.
8. Diversion of sewage during construction.
 - a. Sewage flowing in existing sewer shall be temporarily plugged or diverted around or through the construction by means of by-pass pumping, fluming, or any other means acceptable to the ENGINEER.
 - 1) If by-pass pumping is required, provide stand-by pump equivalent to the largest by-pass pump in service. Reliability of the pumping system must be proven before any sewer can be taken out of service.
 - b. At completion of each work day tie sewage flow back into existing sewer. Tie-in shall be covered so there is no visible sewage.
 - c. Prior to beginning work, the CONTRACTOR shall have on hand all required materials necessary to accomplish the work.
 - d. The CONTRACTOR shall be responsible for any property damage caused by sewage handling.
9. The CONTRACTOR shall maintain a log of service connection locations and lateral pipe lengths and sizes. The locations shall be based upon sewer line stationing and shall indicate if the lateral is in service or plugged.

B. Reconnect Existing Service Laterals

1. Use wye or tee fittings as approved for connecting existing service laterals to the newly-constructed sewer.
2. Replace as much as possible of the existing service lateral with new piping of the same material as the sewer main. Join the new piping with the existing using a Ford style FC1 cast coupling with stainless steel bolts or other approved coupling.
3. When installing new fittings (wye or tee branches, saddles, lateral pipe) in sanitary sewers or making connections to sanitary sewers, appropriate cutting tools, tapping saddles, and rubber repair couplings or adapters with adjustable stainless steel shear rings and clamps shall be used.

C. Connect New Service Lateral Into Existing Sewer Main

1. Connect the new service lateral into the sewer main or an adjacent manhole as directed.
2. Connection to the sewer main shall be made using a tee saddle as specified in paragraph 2.01F and as shown on the Detail Drawing.
3. Connection to an existing manhole shall be in accordance with the requirements of paragraph 2.01G7c and as shown on the Detail Drawing.

D. Ductile Iron Pipe.

1. Push-on Type Joints

- a. The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. These parts shall be kept clean throughout assembly to the joint.
- b. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket. Care shall be taken to insure that the gasket is properly seated.
- c. A minimum amount of lubricant shall be evenly applied to the spigot end with a brush. Gasket lubricant shall be as supplied by the manufacturer.
- d. The spigot end shall be properly centered and force applied, using a ratchet jack-type tool or a roller chain-type ratchet jack, until the white stripe at the spigot end is just visible at the face of the bell.

Any required deflection shall be made only after the joint assembly has been made.

- e. Proper positioning of the gasket shall be checked with a "feeler" gauge after each joint is made.
- f. The edges of "field cut" pipe shall be touched up with a file or grinder so as to remove rough edges and facilitate assembly.

2. Mechanical Joints

- a. Thoroughly clean the bell and the spigot end of the pipe of all foreign matter and wash them with soapy water.
- b. Slip the gland and gasket over the plain end and seat the spigot end in the bell (the small end of the gasket and the lip on the gland shall face the bell).
- c. Push gasket into position with fingers, making sure it is evenly seated.
- d. Move gland into position for bolting, insert bolts and make all nuts fingertight, keeping the spigot centrally located within the bell.
- e. The following table is used in determining the wrench to be used by an average man in tightening the bolts.

<u>Bolt Size</u>	<u>Length of Wrench</u>
5/8"	8"
3/4"	10"
1 1/4"	12"
1 1/2"	14"

- f. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face by partially tightening the bottom bolt first, then the top bolt, next, two bolts at each side, and last, the remaining bolts. Repeat this cycle until all bolts are within the range of the torques listed below:

<u>Bolt Size</u>	<u>Range of Torque</u>
5/8"	40 - 60 ft lb
3/4"	60 - 90 ft lb
1 1/4"	70 - 100 ft lb
1 1/2"	90 - 120 ft lb

- g. If effective sealing is not obtained at the minimum torque indicated above, the joint must be disassembled and reassembled after thorough cleaning. Under no circumstances are bolts to be overstressed.

E. PVC Pipe

- 1. Inspect pipe and fittings for defects or damage prior to lowering into the trench.
- 2. Install PVC pipe and fittings in accordance with manufacturer's written instructions.
- 4. Install metallic-backed PVC warning tape 12" atop each lateral pipe from the main to the property line.
- 5. Use of hydrohammer for compaction will not be permitted within three (3) feet of the top of the pipe.

F. Steel Casing Pipe

- 1. Steel casing pipe shall be installed by one of the following methods (CONTRACTOR's option):
 - a. Boring
 - b. Boring and jacking simultaneously
 - c. Drilling
 - d. Jacking and tunneling
- 2. Rock, if encountered, shall be removed by means of air hammers or other approved means. Blasting will not be permitted unless approved by the ENGINEER.
- 3. Pits shall be of sufficient size to accomplish work. Pits shall be sheeted, shored, and braced as required to prevent subsurface subsidence. Pits shall be kept dry; and pumps shall be attended on a 24-hour basis, if conditions so require.
- 4. The CONTRACTOR shall submit detailed description of all procedures, schedules and details necessary to describe the work to the ENGINEER.

G. Pipe Couplings and Adapters

1. Install pipe couplings and adapters in accordance with the manufacturer's written instructions.
2. Test dig and determine the exact O.D. and ovality of existing pipe before submitting any coupling for approval.

H. Connection of Force Main to Manholes

1. Connection of a force main into a manhole shall be accomplished to minimize splashing.
2. Connection to a new manhole shall be through an opening provided with a gasket as specified in paragraph 2.01G7. Connection to an existing manhole shall be accomplished by coredrilling a hole and sealing the annular space with linkseal provided with stainless steel bolts.
3. Where possible, the force main shall be connected at the channel invert for a new manhole and within 3" of the top of the benching of any existing manhole. A smooth channel shall be provided to direct the discharge into the manhole main channel.
4. Where a force main cannot be connected in accordance with paragraph 3 above, then an inside drop or fittings shall be provided as directed by the ENGINEER. All pipe supports and anchors shall be stainless steel.

I. Anti Seep Collars

1. Anti seep collars shall be installed around the pipe to prevent the migration of water along the pipe through the bedding.
2. Anti seep collars shall be utilized in areas of high ground water table or as directed by the ENGINEER

J. Pipe Anchors

1. Pipe anchors shall be installed around the pipe to prevent the pipe from creeping down a slope due to high flow velocities.
2. Pipe anchors shall be considered when flow velocities exceed 10 fps or as directed by the ENGINEER.

3.02 MANHOLE CONSTRUCTION

A. General

1. Manhole shall consist of precast reinforced concrete round riser sections and eccentric or flat slab top sections on concrete bases, complete with cast iron frames and covers, steps, and protective coatings.
2. The CONTRACTOR shall provide precast reinforced concrete bases for manholes. Poured-in-place bases shall only be used in special cases as approved in writing by the ENGINEER.
3. Manholes shall conform to the design and dimensions shown on the Detail Drawings and to the requirements specified herein.
4. Manhole tops installed within streets and ground surfaces of residential areas shall be set to match existing grade and slope.
5. Where the Drawings show manhole tops to be above existing ground in undeveloped areas and in open country, manhole shall be set at the top elevations called for on the plans, unless otherwise directed by the ENGINEER.
6. All pipes entering or exiting a manhole shall be provided a joint not more than 2' from the exterior face of the manhole wall.
7. A minimum drop of 0.1 feet in pipe invert elevation shall be provided through each manhole.
8. The minimum manhole inside diameter shall be four feet (4'). Larger inside diameters shall be provided as directed by the ENGINEER.

B. Precast Manhole Bases

1. All precast concrete bases shall be installed level and on a 6-inch layer of compacted coarse aggregate.

C. Poured In Place Concrete Manhole Bases

1. Poured in place concrete bases when permitted shall be constructed in accordance with the design and dimensions shown on the Detail Drawings.
2. Concrete shall be vibrated with a mechanical vibrator. The vibrator shall not be attached to the forms and it shall be capable of transmitting vibration to the concrete in frequencies of not less than five thousand impulses per minute.

3. The tops of poured in place manhole bases shall be accurately formed to receive the tongue of the bottom precast concrete manhole section by means of a template to be provided by the manufacturer of the precast concrete manhole section.
4. The concrete manhole base shall be poured monolithically as shown on the Detail Drawings.
5. Connections to sewer piping shall be made by means of a rubber gasket pipe seal which is suitable for casting directly into the concrete of the base wall; caulk groove with polyurethane sealing compound.

D. Concrete Channels

1. In junction manholes, care shall be taken to properly channel the sewage from pipes entering the sides of the manhole to the flow in the main channel.
2. All channels shall be molded in the concrete base and shall be of proper size, cross section, and to required grade; all bends in channels shall be built with the maximum possible radius. Channels shall be finished smooth in a neat and workmanlike manner with steel trowels. No traps or standing water shall be permitted.

E. Precast Concrete Riser and Top Sections

1. All precast reinforced concrete riser and top sections necessary to build a completed manhole shall be furnished, and the different sections shall fit together readily to permit effective jointing. Jointing shall be in accordance with the Detail Drawings.
2. Rubber gasket joints between adjacent sections shall be carefully made in accordance with the written instructions of the manufacturer of the precast concrete manhole sections. After the joints have been made, the annular spaces which remain on the inside and outside of the joints shall be completely filled with non-shrink grout.
3. Preformed plastic sealing compound joints between adjacent sections shall be carefully made in accordance with the written instructions of the manufacturer. After the joints have been made, the preformed plastic sealing compound shall be cut or trowelled smooth across the joint on the inside of the manhole wall. Where required on the Detail Drawings, joints shall also be sealed with non-shrink grout.

4. Lifting holes shall be sealed with properly designed tapered rubber plugs. The plugs shall be driven into the lifting holes to make the holes completely water and air tight. Sealing of lifting holes with non-shrink grout will also be permitted.
5. Adjoining riser and conical top sections shall be fitted together to assure true vertical alignment of manhole steps.

F. Caulking of Pipe Seals

1. Annular spaces between pipe seal and manhole base or wall after pipe connections have been completed shall be completely filled with polyurethane sealing compound. The sealing compound shall be tightly caulked into the annular spaces in such a manner so as to completely fill the annular spaces, and trowelled smooth at the inside face of the manhole base and wall. The polyurethane sealing compound shall be Sikaflex-1A, manufactured by Sika Chemical Company of Lyndhurst, New Jersey, or approved equal.

G. Manhole Steps

1. The manhole steps shall be as shown on the Detail Drawings and shall be set in a straight line on the side of the manhole and spaced as set forth on the Detail Drawings.

H. Drop Manhole Connection

1. Drop manhole connections shall be constructed in accordance with the Detail Drawings at the locations shown on the drawings or as otherwise directed by the ENGINEER. Pipe and fittings shall be the same pipe material that is used in the actual sewer line construction.
2. A minimum of a five (5) foot inside diameter manhole shall be provided.

I. Manhole Frames and Covers

1. Where required, final adjustment of frame to elevation shall be made using precast concrete manhole grade rings. Grade elevation adjustments shall not be permitted to exceed nine (9) inches.
2. Joints between grade rings for leveling units shall be made with preformed plastic sealing compound, and shall be ½ inch thick and trowelled or trimmed smooth on the inside of the manhole. In addition, the leveling units shall be sealed on the outside and inside surface using non-shrink grout.

3. The joint between the bottom of the frame and the top of grade ring leveling units, or the top manhole section as applicable, shall be made with preformed plastic sealing compound and shall be sealed on the outside and inside surface using non-shrink grout.
4. Frames for all manholes not located in paved areas shall be bolted to the manhole as shown on the Detail Drawings. Studs, nuts, and washers shall be of galvanized steel and conform to ASTM A325. Bolts shall have a sufficient number of proper sized threads for proper connection.
5. Bolt frames to top manhole section.
6. Secure covers to frame as shown on the Detail Drawings.

J. Tapping Existing Manholes

1. Tapping of existing manholes shall be in accordance with the requirements of paragraph 2.01G7c and the Detailed Drawing.
2. If the distance between the invert of the new sewer and the existing benching exceeds 1'-6", the inside drop shall be constructed. No tap shall be made in the area between 12" to 18" above the existing benching or through a manhole wall joint.
3. The inside base of the existing manhole shall be modified as required to provide for a smooth transition of flow into the existing channel.

3.03 CONCRETE FOUNDATIONS

- A. Where required by the ENGINEER, or where shown on the Drawings, pipe shall be placed on a formed concrete cradle, or unformed concrete shall be placed around pipes for bedding and encasement.
- B. Concrete cradles shall consist of structures requiring forms and be composed of concrete, built-in trenches to support pipes, and to the dimensions shown on the Detail Drawings.
- C. Concrete bedding and encasement shall be composed of concrete placed in trenches, without forms as pipe bedding, or encased around pipes, to the dimensions and in the locations indicated on the Detail Drawings.

3.04 INSTALLATION OF NEW MANHOLE IN AN EXISTING SEWER MAIN

- A. In the event a manhole has to be installed in an existing sewer main, it shall be accomplished by sawcutting out an appropriate length of sewer main, inserting a precast manhole base with two (2) 2' long SxS SDR 26 PVC pipe lengths of the appropriate diameter installed in the inlet and outlet connections. As an

alternate, 2' long ductile iron pipe (DIP) Class 52 can be used to connect to the manhole base. The new pipe sections shall be joined to the plain ends of the existing sewer main by using an appropriately sized Ford style FC1A cast coupling with stainless steel nuts and bolts or another coupling approved prior to the start of work. Construction and connection of the manhole shall be in accordance with the Detailed Drawings.

- B. During the installation of the manhole, the CONTRACTOR shall pump all sewage flows from the manhole immediately upstream to the manhole immediately downstream. If the existing sewage flow is small and the conditions are acceptable to the ENGINEER, stopping the sewage flow by plugging upstream manhole may be approved.
- C. The construction of a poured-in-place concrete base with a "Doghouse" riser section will only be considered as an alternate to the above under special cases. Approval of this type of construction must be obtained in writing from the ENGINEER.

TABLE I

AIR TEST TABLE

SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED

Pipe Diameter (in)	Minimum Time (min: sec)	Length for Minimum Time (ft)	Time for Longer Length (sec x Length,ft)	Specification Time for Length (L) Shown (min: sec)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	1:53	597	.19 x Length	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 x Length	2:50	2:50	2:50	2:50	2:50	2:50	2:50	2:50	2:51
8	3:47	298	.760 x Length	3:47	3:47	3:47	3:47	3:48	3:48	4:26	4:26	5:04
10	4:43	239	1.187 x Length	4:43	4:43	4:43	4:57	5:56	5:56	6:55	6:55	7:54
12	5:40	199	1.709 x Length	5:40	5:40	5:42	7:08	8:33	8:33	9:58	9:58	11:24
15	7:05	159	1.671 x Length	7:05	7:05	8:54	11:08	13:21	13:21	15:35	15:35	17:48
18	8:30	133	3.846 x Length	8:30	9:37	12:49	16:01	19:14	19:14	22:26	22:26	25:38
21	9:55	114	5.235 x Length	9:55	13:05	17:27	21:49	26:11	26:11	30:32	30:32	34:54
24	11:20	99	6.837 x Length	11:24	17:57	22:48	28:30	34:11	34:11	39:53	39:53	45:35
27	12:45	88	8.653 x Length	14:25	21:38	28:51	36:04	43:16	43:16	50:30	50:30	57:42

SECTION 8

SEWER PIPE TELEVISION

ARTICLE 1 GENERAL

1.01 DESCRIPTION

- A. The work in this section includes, but is not limited to:
 - 1. The internal inspection of the sanitary sewers utilizing closed circuit cameras and associated equipment.
 - 2. The preparation of permanent records of televising activities.
- B. Requirements
 - 1. All newly constructed sewer mains shall be televised prior to any sewer line being accepted for dedication.
- C. Related Work Specified Elsewhere
 - 1. Sewer Line Acceptance Tests - Section 7

ARTICLE 2 PRODUCT

2.01 CAMERA, MONITOR & MOBILE STUDIO

- A. Operation of the equipment shall be controlled from above ground with a skilled technician at the control panel in the television studio, controlling the movement of the television camera. The technician shall have the capability to adjust the brilliance of the built-in lighting system and be able to change the focus of the television camera by remote control.
- B. The color television camera used for the inspection and the back-up camera shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. Picture quality shall be such as to produce a minimum of 600 lines of resolution, in 100% humidity conditions, from the television camera. Picture quality and definition shall be to the complete satisfaction of the ENGINEER and, if unsatisfactory, the equipment shall be removed and replaced with satisfactory equipment and the inspection shall be conducted again at no extra cost to the AUTHORITY.

- C. The view seen by the television camera shall be transmitted to a color television monitor of not less than 9 inches. The television monitors shall be located inside a movable TV studio which shall be large enough to accommodate up to six people for the purpose of viewing a monitor while the inspection is in progress. The ENGINEER shall have access to view a television monitor at all times.
- D. The camera shall be capable of being moved through the sewer line in either direction at a uniform, slow rate by means of manual cable winches or motorized mechanical equipment of the indirect drive type.
- E. A footage meter shall be provided such that the location of the camera and point of reference will be known at all times at ground level. The metering device shall be accurate to two-tenths (0.2) of a foot. A measuring target in front of the television camera shall be used as an exact measurement reference point and the meter shall be designed so that the distance recorder can be set at zero when the camera or packer is at the entrance of the pipe inside the manhole.
- F. The electricity for all TV inspection operations shall be furnished by and at the expense of the CONTRACTOR.
- G. All cables attached to the camera must be of sufficient length to ensure the televising of a given reach of sewer in one continuous operation.
- H. The equipment used to televise the sanitary sewers must be capable of extending a minimum of seven hundred (700) feet per set up.

2.02 RECORDS

- A. Written records of all internal inspection operations shall be prepared by the CONTRACTOR. The records shall be printed in log form acceptable to the ENGINEER, indicating each section of sewer televised, CONTRACTOR's name, date, type and diameter of pipe, length of the sewer section and specific details as to service connection locations, broken pipe, the location of each infiltration point discovered and an estimate of the quantity of infiltration, and any other points of interest noted during the inspection. All locations shall be in relation to adjacent manholes and shall utilize the manhole designations shown on the sewer maps provided by the AUTHORITY. A manhole inspection form acceptable to the ENGINEER must be completed by the CONTRACTOR for each manhole where televising activities have started, terminated, or passed through. A copy of the form must be included with the televising records. An acceptable copy of the written televising logs, the video tapes of the sewer reaches, and the written manhole inspection reports must be delivered to the AUTHORITY.

- B. Video and audio tape recording of the inspection shall be made at the direction of the ENGINEER. The recording tape shall be VHS format and shall become the property of the AUTHORITY after completion of the sewer reach. The recording shall identify and describe the section of sewer line. Stationing shall be given by audio recording at intervals of no less than ten feet and shall be given at all points of interest such as infiltration sources and service connections. The video recording shall continuously indicate tape position and have a variable playback tape speed ranging from normal to one-third normal speed and shall have not less than 180 lines of resolution.

ARTICLE 3 EXECUTION

3.01 EQUIPMENT SET-UP

- A. After a sewer reach has been cleaned, all necessary equipment shall be set-up in preparation for televising. Equipment set-up shall include necessary traffic control, positioning of winches, power cable and TV camera positioning in the manhole.

3.02 TELEVISING ACTIVITIES

- A. The CONTRACTOR is requested to complete as many sewer reaches per equipment set-up as conditions permit.
- B. All televising activities shall be made in the presence of the OWNER and/or ENGINEER.
- C. The camera shall be moved through the line at a uniform rate, not to exceed ½ foot per second by means of cables and winches positioned at each manhole or by a self-propulsion mechanism on the camera. A suitable means of communication shall be established and maintained if remote controlled power winches are not used.
- D. The CONTRACTOR shall stop the camera at all leaks, cracks, laterals, separated joints and defects that might permit infiltration of groundwater into the sewer or where directed by the ENGINEER.
- E. If necessary, the camera shall be removed from the line and the lens cleaned. Picture quality and definition shall be to the complete satisfaction of the ENGINEER. Fogging conditions in the sewer atmosphere shall be eliminated by introducing forced fresh air into the sewer system or by other acceptable methods.

- F. The CONTRACTOR shall prepare the necessary written records and video tapes and manhole inspection forms at the time of televising. Copies of the written records shall be given to the AUTHORITY upon completion of a given reach of sewer. The video tape shall be delivered to the AUTHORITY upon completion of the tape.

SECTION 9

CONCRETE FOR UTILITY CONSTRUCTION

ARTICLE 1 GENERAL

1.01 DESCRIPTION

- A. The Work of this Section includes, but is not limited to:
 - 1. Cast-in-place cement concrete construction
 - 2. Reaction and support blocking
 - 3. Cradles and encasement
- B. Related Work Specified Elsewhere
 - 1. Trenching, Backfilling & Compaction: Section 6

1.02 QUALITY ASSURANCE

- A. Reference Standards
 - 1. Pennsylvania Department of Transportation:
Publication 408 Specifications
 - 2. American Society for Testing and Materials (ASTM):
 - C31 Making and Curing Concrete Test Specimens
in the Field
 - C39 Test for Compressive Strength of
Cylindrical Concrete Specimens
 - C42 Obtaining and Testing Drilled Cores and
Sawed Beams of Concrete
 - C172 Sampling Fresh Concrete

1.03 SUBMITTALS

- A. Certificates
 - 1. Submit certification from the concrete producer attesting that the cement concrete conforms to Section 704, Publication 408 Specifications for the class of concrete being used.

2. Submit certified results of compressive strength tests performed by an independent testing laboratory.

B. Shop Drawings

1. Submit detailed shop drawings of reinforcing steel.

ARTICLE 2 PRODUCTS

2.01 CEMENT CONCRETE

A. Ready-mixed, conforming to Section 704, Publication 408 Specifications.

1. Requirements for State approved batch plants, design computations and plant inspection shall not apply. The acceptability of concrete will be based on conformance with the Cement Concrete Criteria specified below and the results of the specified tests.

B. Cement Concrete Criteria

1. Class A

- a. 28-day compressive strength: 3300 psi
- b. Slump: 1 to 3 inches

2. Class C

- a. 28-day compressive strength: 2000 psi
- b. Slump: 2 to 6 inches

3. High Early Strength

- a. 3-day compressive strength: 3000 psi
- b. Slump: 1 to 3 inches

4. Cement Factor and Maximum Water-Cement Ratio conforming to Table A, Section 704.1(b), PaDOT Publication 408 Specifications.

2.02 REINFORCEMENT STEEL

A. Reinforcement Bars

1. New billet-steel conforming to Section 709.1, Publication 408 Specifications.
2. Deformed, Grade 40

B. Steel Wire Fabric

1. Conforming to Section 709.3, Publication 408 Specifications

2.03 GROUTS

A. General

1. All grouting as indicated or noted on the Drawings, in other sections of the specification or obviously required to perform the work shall be non-shrink grout.
2. Grout in general shall be non-metallic type unless specifically noted on the Drawings or in other sections of the specifications to be a metallic type.
3. Grouting shall be in strict compliance with the directions contained in the manufacturer's current catalog or instructions provided with the product.
4. The grout manufacturer shall make available at no cost, upon 72 hours notification, the services of a qualified full-time field representative to aid in assuring proper use of the product under job conditions.

B. Non-metallic Type.

1. Non-metallic grout shall be Masterflow 713 Grout (pre-mixed) as manufactured by Master Builders.

C. Epoxy Based Grouts shall be a 2 component, moisture insensitive epoxy adhesive, such as Sikadur 32 Hi-Mob by Sika Corporation.

ARTICLE 3 EXECUTION

3.01 CONSTRUCTION

- A. Comply with Section 1001, Publication 408 Specifications for construction requirements including formwork, curing, protection and finishing of cement concrete.
- B. Excavate and shape trench bottoms and sides to accommodate thrust block forms, encasement, manhole bases, inlets and vaults.
- C. Support pipe, valves and fittings at the required elevation with brick or concrete block. Do not use earth, rock, wood, or organic material as supports.
- D. Construct manhole bases, reaction and support blocking, cradles, encasements, and miscellaneous mass concrete of Class A concrete.
- E. Provide spacers, chairs, bolsters, ties and other devices for properly placing, spacing, supporting and fastening reinforcement in place.
- F. Place concrete utilizing all possible care to prevent displacement of pipe or fittings. Return displaced pipe or fittings to line and grade immediately.
- G. Insure tie rods, nuts, bolts and flanges are free and clear of concrete.
- H. Do not backfill structures until concrete has achieved its initial set, forms are removed, and concrete work is inspected by the ENGINEER.
- I. Perform backfilling and compaction as specified in Section 6.

3.02 FIELD TESTS OF CONCRETE DURING CONSTRUCTION

- A. Test each 50 cubic yards or fraction thereof of each class of concrete for compressive strength. Retain an independent testing laboratory to test cylinders.
 - 1. Sample concrete in accordance with ASTM C172
 - 2. Prepare and cure two test cylinders in accordance with ASTM C31.
 - 3. Test cylinders in accordance with ASTM C39
- B. If test cylinders fail to meet strength requirements, the ENGINEER may require additional core tests in accordance with ASTM C42 at the expense of the CONTRACTOR.

SECTION 10

PAVING AND RESURFACING

ARTICLE 1 GENERAL

1.01 DESCRIPTION

- A. The work of this section includes, but is not limited to:
 - 1. Temporary Paving
 - 2. Permanent Paving
 - 3. Shoulder Restoration
 - 4. Curb and Sidewalk Restoration

- B. Related work specified elsewhere:
 - 1. Trenching, Backfilling and Compacting: Section 6
 - 2. Concrete For Utility Construction: Section 9

- C. The CONTRACTOR and ENGINEER shall, prior to construction, make a visual reconnaissance, of all paved areas, determining the actual condition of the paving. Notes, photographs, etc., shall be made and kept on file at the ENGINEER's office for possible future reference. CONTRACTOR shall not disturb areas prior to the existing conditions being documented.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Pennsylvania Department of Transportation:
 - a. Publication 408 Specifications, 1996
 - b. Publication 27 - Specification for Bituminous Mixtures (Bulletin 27)
 - c. Publication 37 - Specification for Bituminous Materials (Bulletin 25)
 - d. Publication 203 - Work Zone Traffic Control

1.03 SUBMITTALS

A. Certificates:

1. Submit certification from bituminous and aggregate suppliers attesting that materials conform to the State specifications.

1.04 JOB CONDITIONS

A. Control of Traffic:

1. Take measures to control traffic during repaving operations. Do not allow traffic on repaved areas until authorized by the ENGINEER.
2. Employ traffic control measures in accordance with Publication 203 - "Work Zone Traffic Control" and the Contract Drawings.
 - a. Unless otherwise noted on the plans, CONTRACTOR shall submit details of all traffic control measures to be utilized. No traffic control measures may be used until CONTRACTOR receives approval from the ENGINEER in writing.

- #### B. Restore existing paving outside the limits of the work, that is damaged by the CONTRACTOR's operations, to its original condition at the expense of the CONTRACTOR.

ARTICLE 2 PRODUCTS

2.01 CONCRETE

- #### A. The concrete materials for streets shall conform to the applicable provisions of Section 704, CEMENT CONCRETE AND READY MIX CEMENT CONCRETE, in Commonwealth of Pennsylvania, Department of Transportation Specifications, Form 408.
- #### B. The concrete materials for walks, curbing and driveways shall be Class A, 3300 psi Concrete and shall conform to the specifications of Section 9.

2.02 CRUSHED STONE BASE COURSE

- #### A. Crushed stone base course shall be PennDOT No. 2RC Crushed Stone or AASHTO 2RC stone and shall be in accordance with Section 350 - Subbase of PennDOT Specifications, Publication No. 408, 1996.
- #### B. Crushed slag shall not be used for this material.

2.03 BITUMINOUS CONCRETE BASE COURSE

- A. Bituminous concrete base course shall conform to Section 305 of PennDOT Specifications, Publication No. 408, 1996.

2.04 BITUMINOUS BINDER COURSE ID-2

- A. Bituminous binder course ID-2 shall conform to Section 421 of PennDOT Specifications, Publication No. 408, 1996.

2.05 BITUMINOUS TACK COAT

- A. Bituminous tack coat shall conform to Section 460 of PennDOT Specifications, Publication No. 408, 1996.

2.06 BITUMINOUS WEARING COURSE ID-2

- A. Bituminous wearing course ID-2 shall conform to Section 420 of PennDOT Specifications, Publication 408, 1996.

2.07 MILLING OF BITUMINOUS PAVEMENT SURFACE

- A. Milling of bituminous pavement surface shall conform to Section 491 of PennDOT Specifications, Publication 408, 1996.

2.08 JOINT SEALING

- A. Joint sealing shall conform to Section 401 of PennDOT Specifications, Publication No. 408, 1996.

2.09 CRACK FILLING AND SEALING

- A. Crack filling and sealing shall conform to Section 469 of PennDOT Specifications, Publication No. 408, 1996.

2.10 BITUMINOUS PAVED SHOULDERS TYPE 6 and TYPE 6I

- A. Paved shoulders Type 6 and Type 6I shall conform to Section 656 of PennDOT Specifications, Publication 408, 1996.

2.11 CONCRETE SHOULDERS

- A. Concrete shoulders shall conform to Section 658 of PennDOT Specifications, Publication No. 408, 1996.

2.12 CEMENT CONCRETE SIDEWALKS

- A. Cement concrete sidewalks shall conform to Section 676 of PennDOT Specifications, Publication No. 408, 1996.

2.13 EXPANSION JOINT MATERIAL

- A. Expansion joint material shall conform to Section 705 of PennDOT Specifications, Publication No. 408, 1996.

2.14 WELD WIRE FABRIC

- A. Weld wire fabric shall conform to Section 709 of PennDOT Specifications, Publication No. 408, 1996.

2.15 CONCRETE

- A. Concrete shall conform to Section 704 of PennDOT Specifications, Publication No. 408, 1996.

2.16 LINE PAINTING

- A. Line painting shall conform to Section 962 of PennDOT Specifications, Publication No. 408, 1996.

2.17 MANHOLE ADJUSTING RINGS

- A. For raising manhole covers an acceptable manhole raising device shall be provided. The device shall be a solid adjusting ring or an adjustable manhole extension device.

2.18 RAISING MANHOLE COVERS AND VALVE BOXES

- A. Install the adjusting rings in all sewer manholes that require adjusting to meet the elevation of the repaving.
- B. Coordinate the raising of all valve boxes and/or manhole covers belonging to other utilities.
- C. The CONTRACTOR shall be responsible to see that all such items as mentioned above are adjusted to the new paving elevation.

ARTICLE 3 EXECUTION

3.01 MISCELLANEOUS

- A. All materials of construction shall conform to all applicable sections of PennDOT Specifications, Publication 408, 1996.
- B. Restore existing paving outside the limits of the work, that is damaged by the CONTRACTORs operation, to the original condition, to the satisfaction of the ENGINEER, at the expense of the CONTRACTOR.
- C. All finish paving shall be completed to match the finish grade of the adjacent existing pavement unless otherwise specified on the Contract Drawings.
- D. The CONTRACTOR shall seal all joints between new pavement and existing pavement, including roads, driveways, manholes, inlets, curbs, water boxes, etc. in accordance with Section 401 of the PennDOT Specifications, Publication 408, 1996. This work is incidental to the installation of the bituminous material.
- E. Upon completion of the paving, any stretch marks, cracks, open seams, etc. which allow the penetration of water and dirt shall be repaired in accordance with instruction by the ENGINEER.
- F. Final restoration shall be completed by the CONTRACTOR within sixty (60) days of first disturbance in all paved areas. The only time extension which will be considered will be due to weather.
- G. All restored areas shall be maintained by the CONTRACTOR until expiration of the maintenance bond period as required by the TOWNSHIP or AUTHORITY.

3.02 SURFACE PREPARATION

- A. The surface shall be prepared and cleaned by the CONTRACTOR.
- B. The CONTRACTOR shall apply a tack coat to the existing bituminous pavement prior to placing the new wearing course.
- C. The CONTRACTOR shall cut joints at all paved road connections. This work is incidental to the wearing course installation.
- D. All waste material removed from the roadway area shall be disposed of at a site provided by the CONTRACTOR.
- E. The road surface shall not be muddy or otherwise unsatisfactory when the binder and/or wearing course is placed thereon.

3.03 TRAFFIC CONTROLS

- A. The CONTRACTOR shall provide traffic controls as previously approved by the owner of the roadway. All traffic controls shall meet PennDOT criteria. The TOWNSHIP and AUTHORITY shall be notified a minimum of three (3) days in advance of any construction in the roadway.

3.04 ROADWAY EXCAVATION AND SUBBASE PREPARATION

- A. The CONTRACTOR shall smooth cut the existing pavement at all limits of work. This work is incidental to the excavation of the roadway.
- B. The CONTRACTOR shall excavate and remove the existing road materials, rubble, stone and rock to the depth shown on the Plans or suitable subgrade.
- C. All waste material removed from the road excavation shall be disposed of at a site provided by the CONTRACTOR.
- D. The CONTRACTOR shall recompact the subgrade using equipment and methods in accordance with PennDOT Specifications, Publication No. 408, Section 210 Subgrade and approved by the ENGINEER.
- E. The subgrade shall not be muddy or otherwise unsatisfactory when the stone subbase is placed thereon.
- F. The CONTRACTOR shall construct a subbase of approved aggregate to the depth and width shown on the Plans. The trench for the installation of the stone shall have a minimum width of 36". The stone shall be compacted and brought to the grade as shown on the Plans. The minimum size roller shall be a small vibrating trench roller approved by the ENGINEER. All materials and methods of construction shall conform to all applicable sections of PennDOT Specifications, Publication No. 408.

3.05 STONE ACCESS AND PARKING AREAS

- A. Stone parking areas shall be 10" of PennDOT No. 2RC stone over Class 2 Type "A" Filter Fabric on approved and compacted subbase as indicated on the Contract Drawings.
- B. Parking areas shall extend to the limits as shown of the Drawings.

3.06 DRIVEWAYS

- A. Driveways shall be restored to existing dimensions or reconstructed to the limits as shown on the Plans as directed by the AUTHORITY or TOWNSHIP.

1. Bituminous Driveways
 - a. Bituminous driveways shall be 2" of ID-2 wearing course over 6" of PennDOT No. 2RC stone on approved and compacted subbase.
 - b. Seal all joints.
 2. Concrete Driveways
 - a. Concrete driveways shall be 6" of Class A, 3300 psi Concrete with 6 x 6 Welded Wire Fabric over 6" of PennDOT No. 2RC stone on approved and compacted subbase.
 - b. Provide performed expansion joint, where new concrete joins existing concrete and at intervals as directed by ENGINEER.
 - c. Form joints with a 1/4" radius edging tool.
 - d. Provide light broom finish.
 3. Stone Driveways
 - a. Stone driveways shall be 10" of PennDOT 2RC stone over Class 2 Type "A" Filter Fabric on approved and compacted subbase.
 4. Concrete Driveway Apron
 - a. Apron extends from depressed curb or joint with street to the furthest most point of the sidewalk.
 - b. Concrete apron shall be 6" of Class A, 3300 psi Concrete with 6 x 6 WWF over 6" of PennDOT No. 2RC on approved and compacted subbase.
 - c. Provide expansion joint where new concrete joins existing concrete and at intervals as directed by the ENGINEER.
 - d. Form joints with a 1/4" radius edging tool.
 - e. Provide light broom finish.
- B. The existing edges of all driveways shall be cut square.

3.07 SIDEWALKS

- A. Sidewalks shall be replaced to original limits or installed to the limits indicated in the Plans as directed by the AUTHORITY or TOWNSHIP.
1. Concrete Sidewalks
 - a. Concrete sidewalks shall be 4" Class A, 3300 psi Concrete over 4" PennDOT #57 stone on approved and compacted subbase.
 - b. Provide a light broom finish.
 - c. Form outside edges and joints with a 1/4" radius edging tool.
 - d. Form joints at 5 feet intervals, approximately 1/8" mill and 1" deep.
 - e. Provide full depth 1/2" thick premolded expansion joints at 20', and stagger with expansion joints in curbing.
 - f. Sidewalks to be a minimum of 4' wide.
 - g. The existing sidewalk shall be broken off evenly at the nearest "groove" or "dummy joint" on both sides of the trench.
 2. Bituminous Sidewalks
 - a. Bituminous sidewalks shall be 1 1/2" of ID-2 wearing course over 6" of PennDOT No. 2RC on approved and compacted subbase.
 - b. Seal all new or cut joints.
 - c. Sidewalks to be a minimum 4' wide.
 3. Handicapped Ramps
 1. Ramps shall comply with most recent ADA approved standards and the following:
 - a. Handicapped ramps shall be provided as indicated on the plans or directed by the ENGINEER.
 - b. Handicapped ramps shall be a minimum of 4" Class A, 3300 psi Concrete over 4" PennDOT #57 stone on approved and compacted subbase.

- c. Provide a light broom finish.
- d. Form outside edged and joints with a 1/4" radius edging tool.
- e. Ramp to be a minimum of 36" wide and shall slope at 1:12.

3.08 CONCRETE CURBING

- A. Curbs shall be replaced in ten (10) foot sections with expansion joints every twenty (20) feet.
- B. New concrete curbing shall be 8" wide x 18" deep and shall have a reveal and cross-section that matches the existing curb.
- C. Provide 1/2" thick premolded expansion joints at 20' and stagger with expansion joints in sidewalk.
- D. Curbs shall be Class A, 3300 psi Concrete.
- E. Place depressed curbs for drives or curb cuts where indicated or directed by ENGINEER.
- F. Curb depressions shall be provided with a smooth transition. This transition shall be over a minimum of 36".
- G. Existing concrete curbing damaged by construction shall be replaced to match existing.
- H. Reconstruct curbs to the first expansion joint on either side of damaged portion and install new expansion joint material.

3.09 CONCRETE SWALES

- A. Concrete swales shall be replaced or installed to the limits indicated on the Plans as directed by the ENGINEER.
- B. Existing swales which are removed shall be replaced with similar.
- C. Existing swales shall have saw cut straight joint lines parallel to the centerline of the swale.
- D. Reconstruct swales to the first expansion joint on either side of the area to be removed and install new expansion joint material.

- E. New concrete swales shall be a minimum of 36" wide and shall be 6" Class "A", 3300 psi Concrete over 6" of PennDOT 2RC on approved and compacted subbase.
- F. Provide expansion joint where new concrete joins existing concrete.
- G. Provide 1/2" thick premolded expansion joints at 20'.

3.10 BITUMINOUS SWALES

- A. Bituminous swales shall be replaced or installed to the limits indicated on the Plans.
- B. Existing swales which are removed shall be replaced in kind.
- C. Existing swales shall have saw cut straight joint lines parallel to the centerline of the swale.
- D. New swales shall be 1 1/2" ID-2 wearing course over 6" PennDOT 2RC on approved and compacted subbase.
- E. All joints shall be sealed.

3.11 PAVED PARKING AREAS

- A. Existing paved parking area shall have sawcut straight joint lines parallel to the centerline of the trench.
- B. Restoration shall be 6" compacted 2A Modified Stone Sub-base, 2" BCBC Base and 1 1/2" ID-2 Wearing Course.
- C. All joints shall be sealed. Sealant shall be applied at a minimum of 4" in width.

3.12 RESTORATION MUNICIPAL ROADWAYS

- A. Roadways shall be reconstructed to the limits indicated on the Plans or as directed by the ENGINEER.
- B. Existing roadway shall have saw cut straight joint lines parallel to the centerline of the trench.
- C. All joints shall be sealed. Sealant shall be applied for a minimum width of 4".

3.13 SHOULDER RESTORATION MUNICIPAL ROAD

- A. Shoulders shall be reconstructed to the limits indicated on the Plans as directed by the ENGINEER.
- B. Existing shoulders and roadway shall have saw cut straight joint lines parallel to the centerline of the trench.
- C. Shoulder restoration shall be compacted suitable backfill.
- D. Seal all joints for a minimum width of 4-inch each side of the joint.

3.14 SWALES

- A. Swales shall be restored to the limits indicated on the Plans or as directed by the ENGINEER.
- B. Swales which are not paved shall be restored to the lines and grades that existed prior to construction. They shall be brought to within 12" of existing grade and lined with rip-rap minimum size to be R-4 for a minimum thickness of 12". The swale width shall be equal to the swale width prior to construction.
- C. Rip rap shall extend 3'-0" in either direction longitudinally beyond the disturbed area.
- D. If flows in swale exceed that which a R-4 can stabilize, ENGINEER may direct CONTRACTOR to utilize a larger rock within the swale.

3.15 Temporary Paving

- A. Temporary paving shall be installed to the limits indicated on the Plans or as directed by the ENGINEER.
- B. Temporary paving shall be installed immediately after trench backfill is brought to needed grades in paved areas.
- C. Shape and compact subgrade material, then place and compact crushed stone base course to the required thickness.
- D. The temporary paving between March 1 and October 31 shall consist of hot-mixed, hot laid, bituminous concrete, and maintained for a minimum of forty-five (45) days.

- E. The temporary paving between November 1 and the end of February shall consist of bituminous stockpile patching material in accordance with PennDOT Bulletin 27, Section 484, or 485 of Form 408 placed on top of the compacted backfill, and maintained until trench is permanently restored.
- F. Place temporary paving material. Compact to required minimum thickness with trench roller having minimum 300 pounds per inch-width of compaction roll.
- G. Continuously maintain temporary paving to the satisfaction of the ENGINEER and the State and local road departments. Temporary paving on State roads must remain in place for a minimum of 45 days.

3.16 TEMPORARY ACCESS ROADS NEEDED BY CONTRACTOR

- A. Access roads shall be installed where needed by the CONTRACTOR to perform the work.
- B. Temporary access roads shall be AASHTO No. 1 rock a minimum of 8" over Class 2, Type A Filter Fabric.
- C. Access road shall be maintained until CONTRACTOR has progressed sufficiently enough as to no longer need road.

3.17 LINE PAINTING

- A. Line painting shall be in accordance with Section 962 of PennDOT Specifications, Publication No. 408, 1996.
- B. Line painting shall take place and be completed the same day as temporary paving and/or paving.
- C. Utilize Type I - Traffic Zone Paint, color to match existing.

3.18 PROPERTY MARKERS

- A. Property markers which are removed as a result of construction activities shall be replaced by a licensed surveyor.
- B. Property markers shall be installed prior to substantial completion and shall be incidental to the cost of the project.

3.19 DRIVEWAY STORMWATER PIPES

- A. Driveway stormwater pipes which are removed as a result of construction activities shall be replaced.

- B. Driveway stormwater pipes damaged by the CONTRACTOR shall be replaced with concrete pipes of similar size. Minimum size of replacement pipe shall be 12".
- C. Swales adjacent to driveway pipes shall be restored, regraded and stabilized to provide smooth transition entering and exiting pipe.

3.20 ROADWAY SIGNS

- A. All roadway signs which must be removed in order to perform construction activities shall be replaced with same in the same location.
- B. If needed, new signs shall be in accordance with Sections 1103 of PennDOT Specifications, Publication No. 408, 1996. and the latest revision of PennDOT Publication 68, Title 67, Chapter 211 - Official Traffic Control Devices.

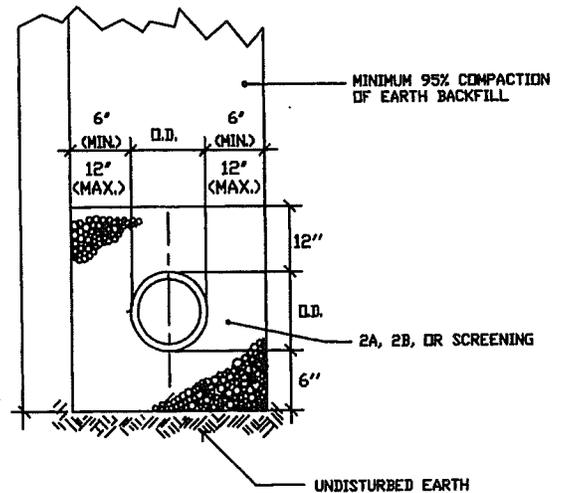
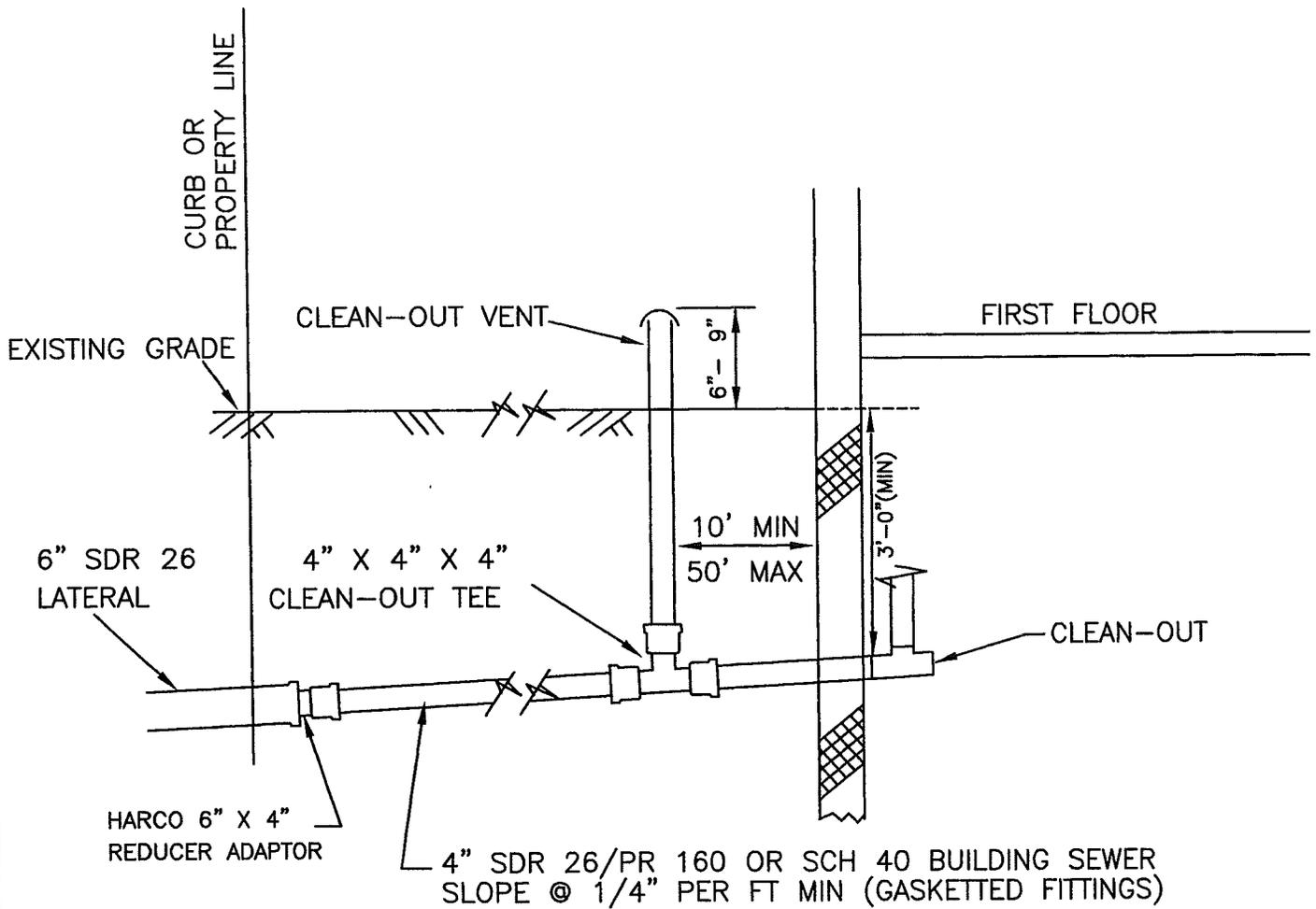
3.21 DELIVERY TICKET (PAVING MATERIALS)

- A. A delivery ticket indicating the quantities and types of paving material shall be submitted at the time of delivery. The complete delivery ticket shall be delivered to the ENGINEER. Failure to deliver such complete ticket to the ENGINEER will be cause for the ENGINEER to reject paving material.

3.22 SURFACE IDENTIFICATION

- A. In accordance with "Occupancy of Highways by Utilities", Chapter 41, a mark of identification shall be placed at the nearest edge of the cut closest to the edge of the improved surface for each opening or impairment made within the improved surface of a State Highway.
- B. The paint shall be of a durable wearing quality and shall be color coded as follows:
 - 1. Blue - Water Lines
 - 2. Green - Sewer Lines
 - 3. Red - Electric Lines
 - 4. Yellow - Natural Gas Lines
- C. CONTRACTOR to mark all pavement following permanent restoration.

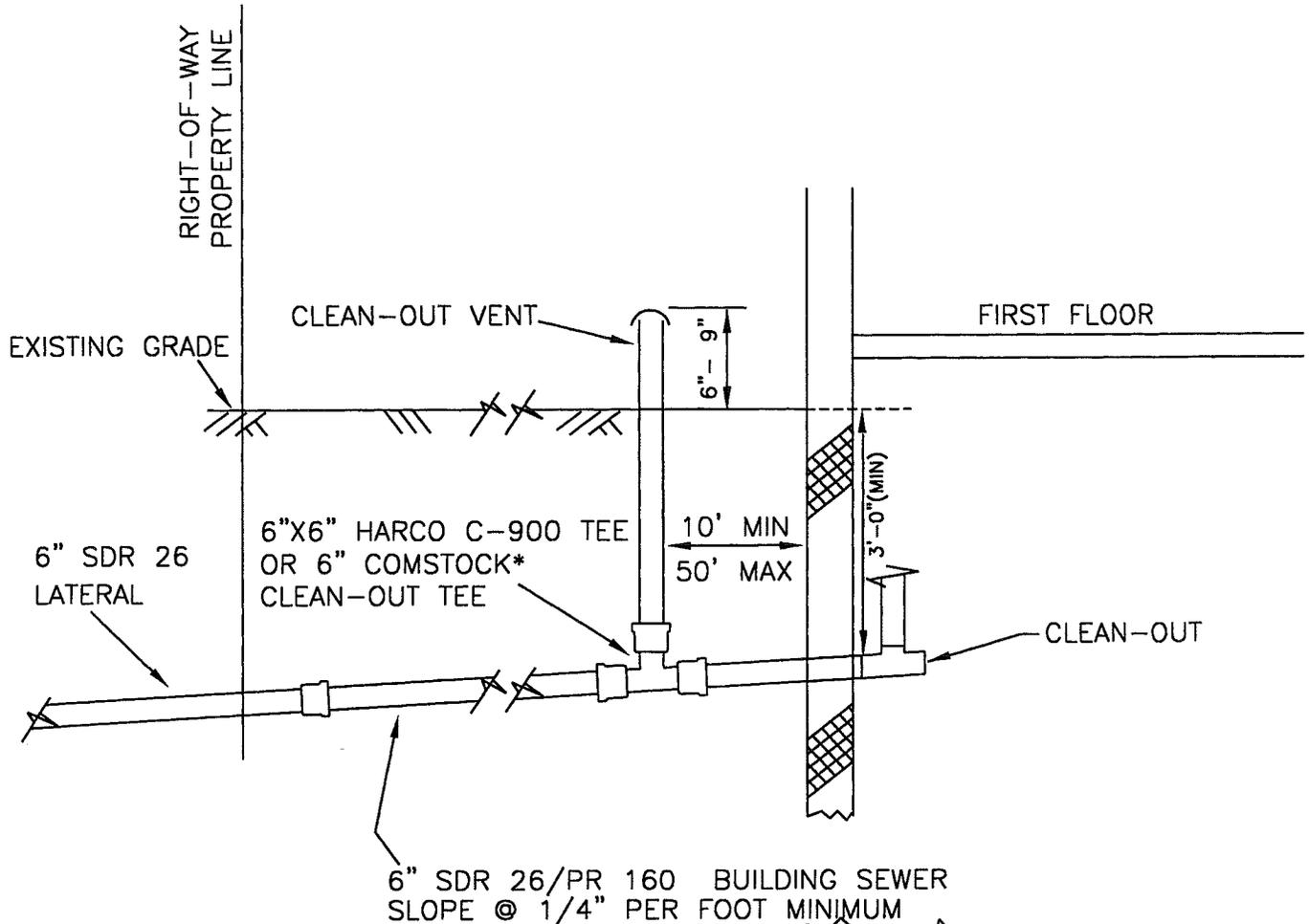
DETAIL DRAWINGS



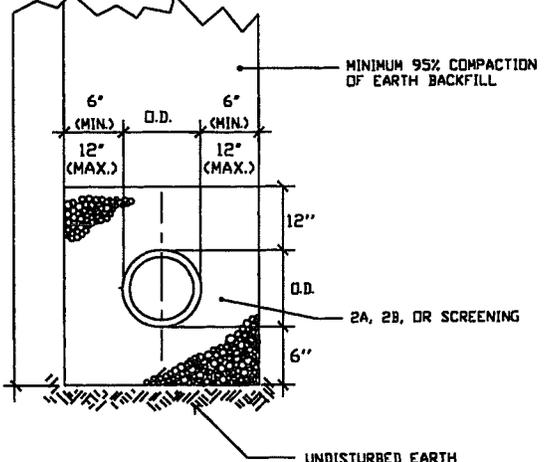
NOTES:

1. ALL BUILDING SEWERS TO BE TESTED PER TOWNSHIP CODES
 2. BUILDING SEWER TO BE TELEVISED AFTER INSTALLATION
 3. CLEAN-OUT REQUIRED ONE PER 100 FEET OF PIPE AND AT EVERY BEND
 4. SPECIFIC SITE PLAN REQUIRED FOR PLUMBING PERMIT FOR TOWNSHIP
 5. AS-BUILT PLAN REQUIRED FOR BUILDING SEWER PRIOR TO OCCUPANCY PERMIT BEING ISSUED BY TOWNSHIP
- * SCH 40 PVC-DWV

BUILDING SEWER CONNECTION
(SINGLE CLEAN-OUT, NO TRAP)



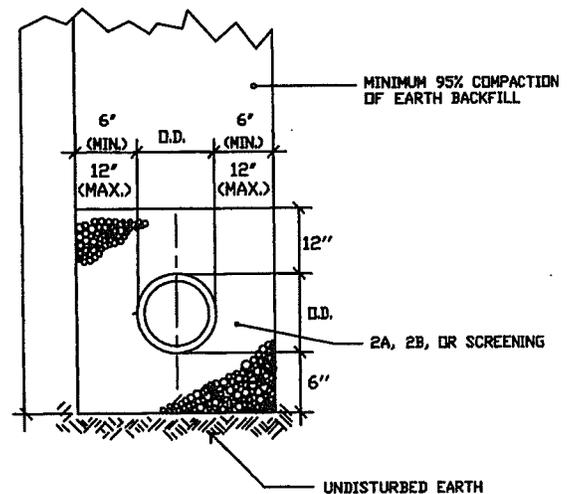
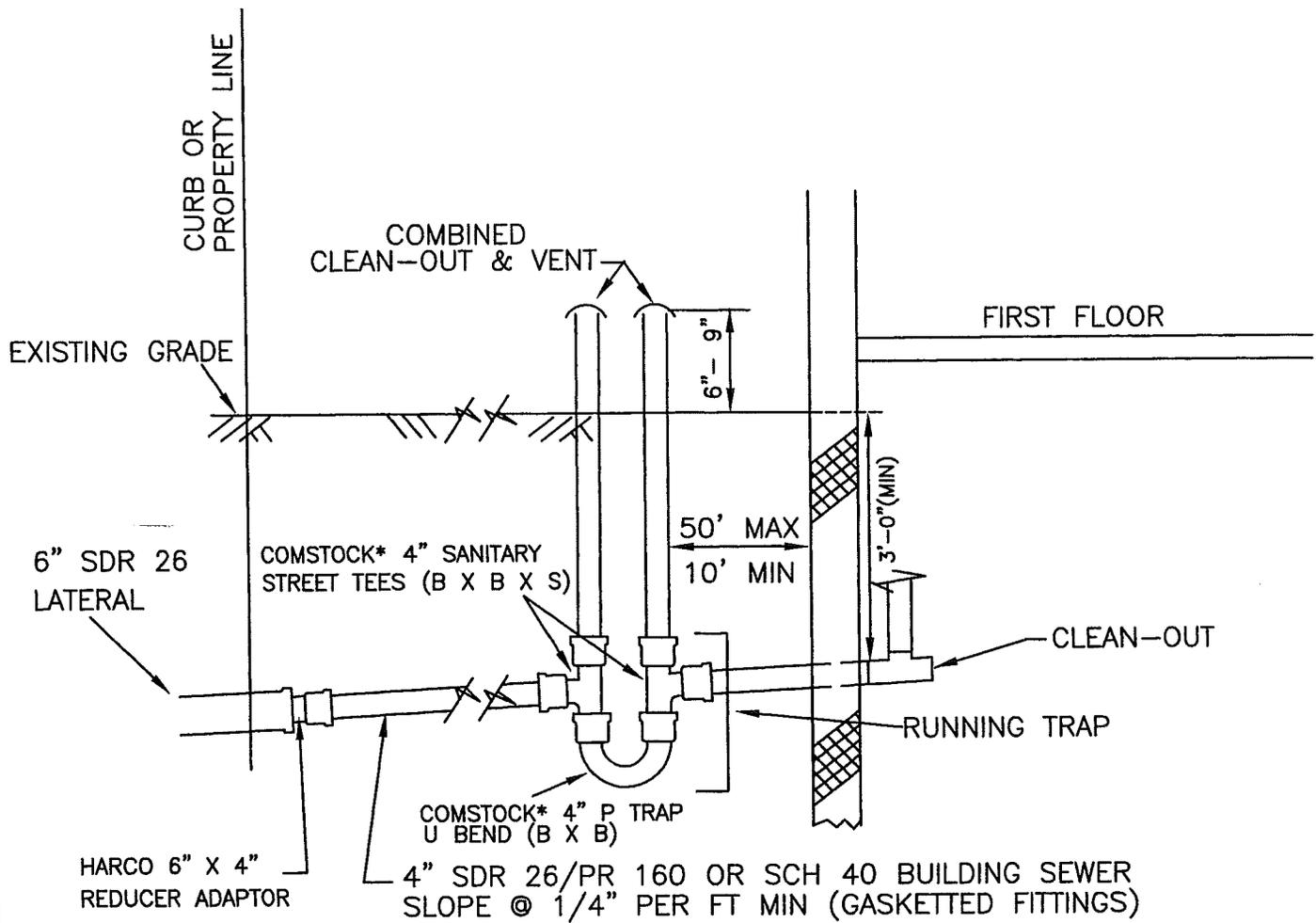
6" SDR 26/PR 160 BUILDING SEWER
SLOPE @ 1/4" PER FOOT MINIMUM



NOTES:

1. ALL BUILDING SEWERS TO BE TESTED PER TOWNSHIP CODES
2. BUILDING SEWER TO BE TELEVISED AFTER INSTALLATION
3. CLEAN-OUT REQUIRED ONE PER 100 FEET OF PIPE AND AT EVERY BEND
4. SPECIFIC SITE PLAN REQUIRED FOR PLUMBING PERMIT FOR TOWNSHIP
5. AS-BUILT PLAN REQUIRED FOR BUILDING SEWER PRIOR TO OCCUPANCY PERMIT BEING ISSUED BY TOWNSHIP

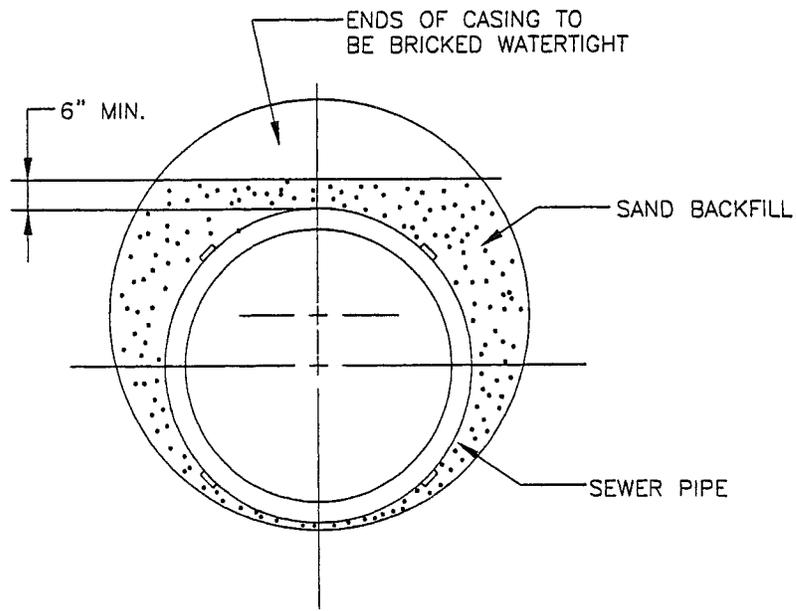
6" DIAMETER BUILDING SEWER CONNECTION



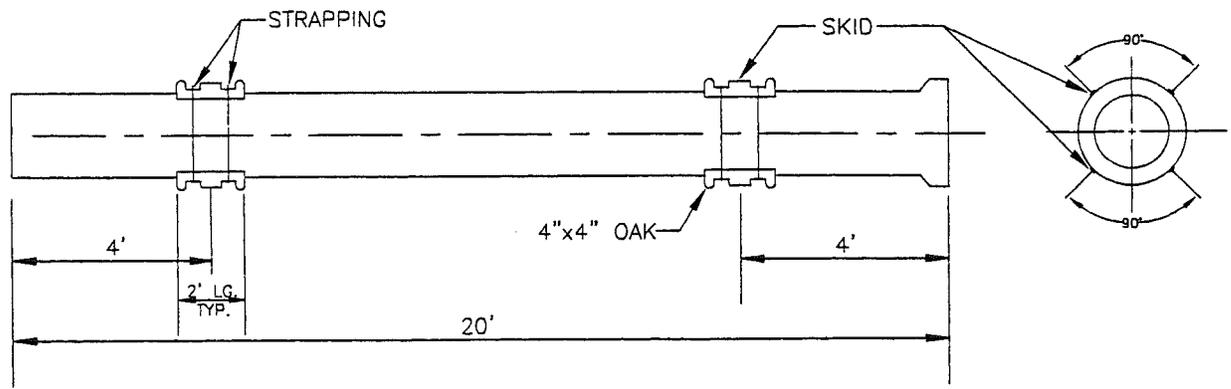
NOTES:

1. ALL BUILDING SEWERS TO BE TESTED PER TOWNSHIP CODES
 2. BUILDING SEWER TO BE TELEVISED AFTER INSTALLATION
 3. CLEAN-OUT REQUIRED ONE PER 100 FEET OF PIPE AND AT EVERY BEND
 4. SPECIFIC SITE PLAN REQUIRED FOR PLUMBING PERMIT FOR TOWNSHIP
 5. AS-BUILT PLAN REQUIRED FOR BUILDING SEWER PRIOR TO OCCUPANCY PERMIT BEING ISSUED BY TOWNSHIP
- * SCH 40 PVC-DWV

BUILDING SEWER CONNECTION
(COMBINED CLEAN-OUT, TRAP, & VENT)



CASING FILL DETAIL

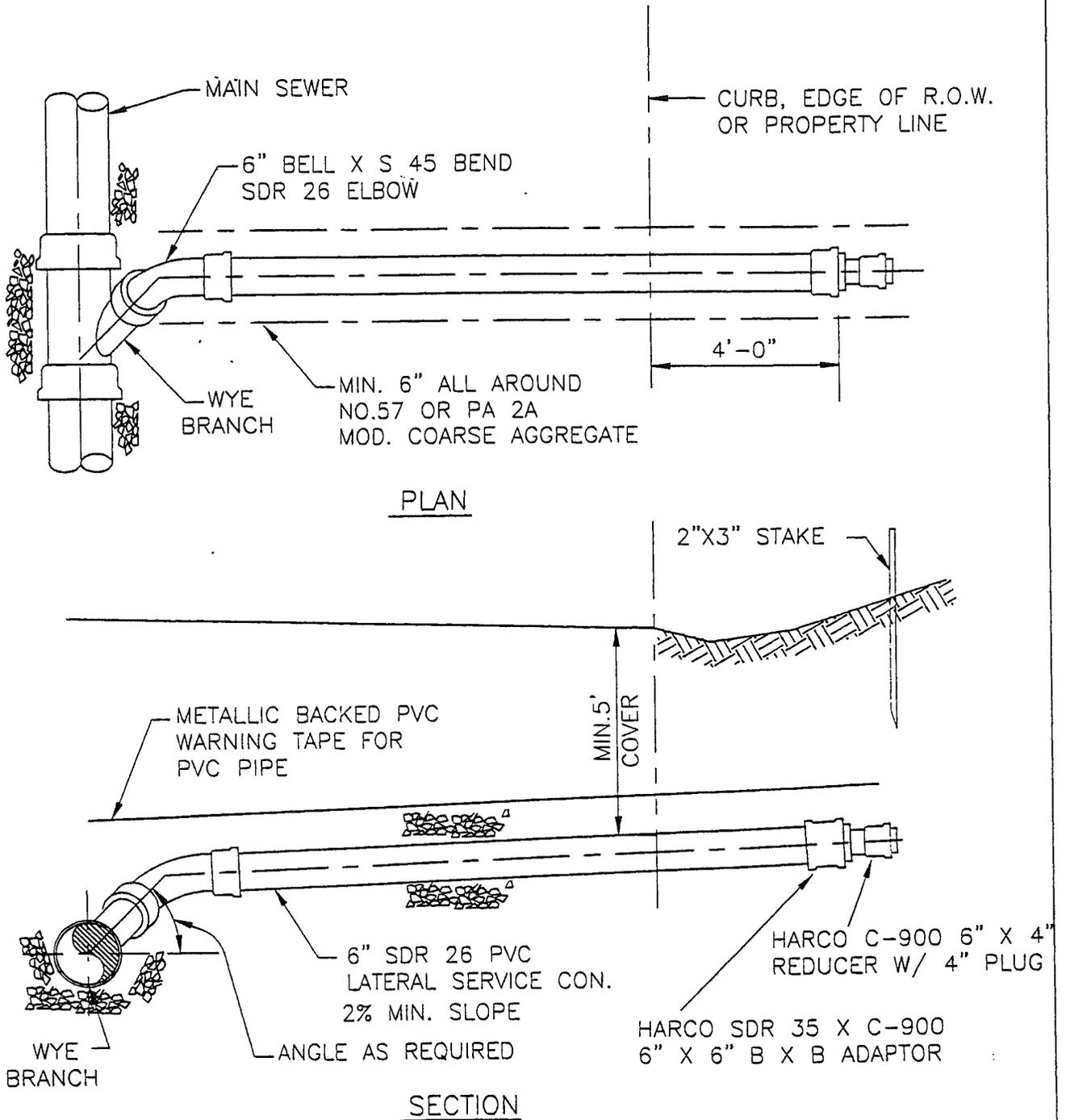


SKID PLACEMENT DETAIL

CASING DETAIL

NOTES:

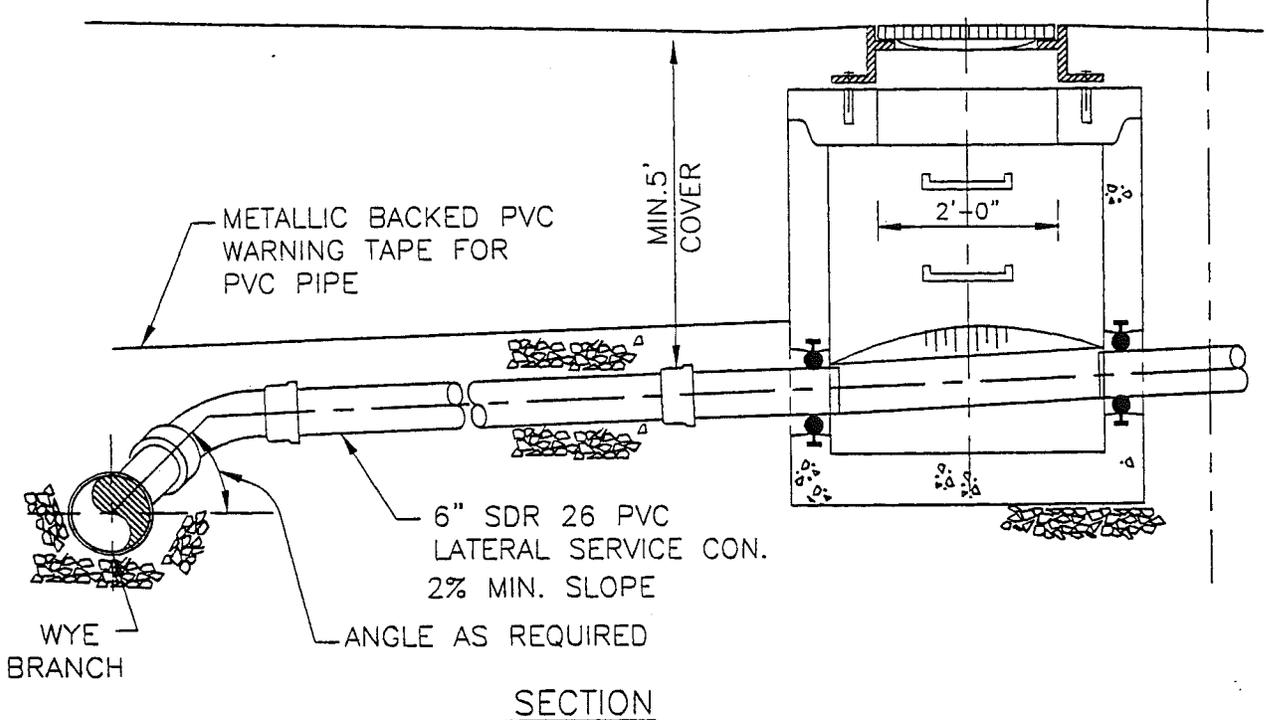
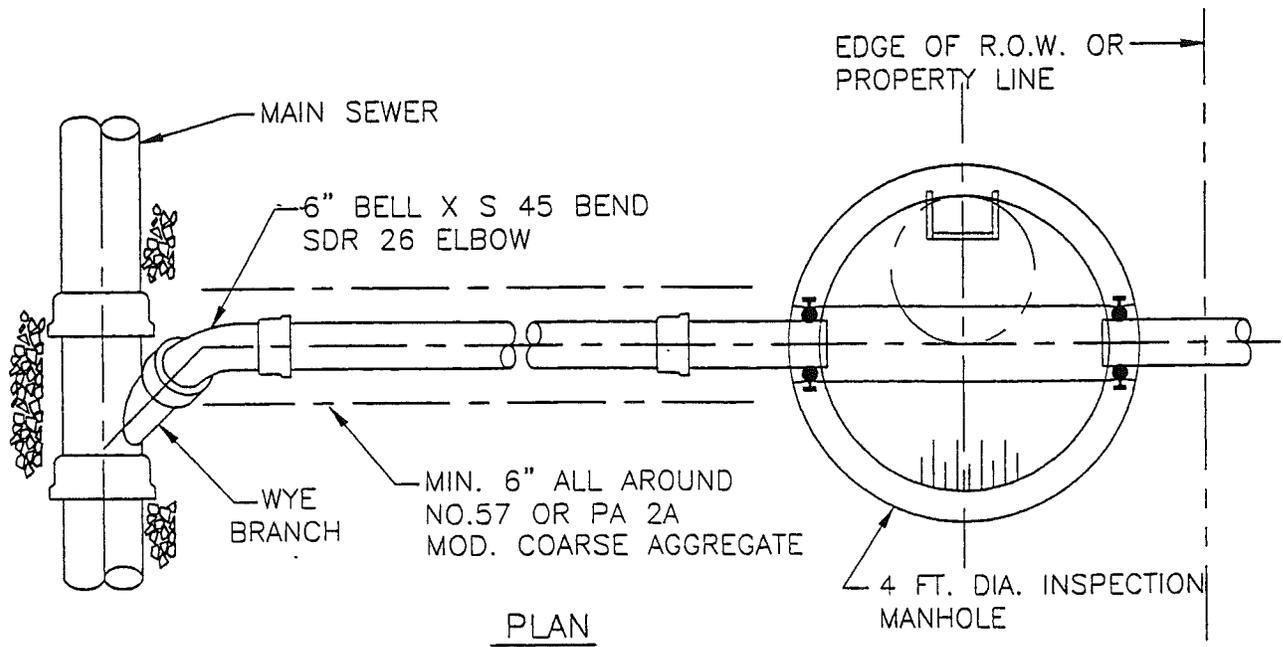
1. IF CURBING OR PAVING DOES NOT EXIST, LATERAL WILL BE 10 FEET IN LENGTH OR FOUR (4') FEET PAST THE EDGE OF THE RIGHT-OF-WAY, WHICHEVER IS GREATER.
2. CONNECTION FROM SERVICE LATERAL TO STRUCTURE SHALL BE IN ACCORDANCE WITH TOWNSHIP PLUMBING CODE.
3. PROVIDE STAKE (2"X3") AT END OF LATERAL EXTENDING 1 FT. ABOVE FINISHED GRADE.



TYPICAL LATERAL DETAIL

NOTES:

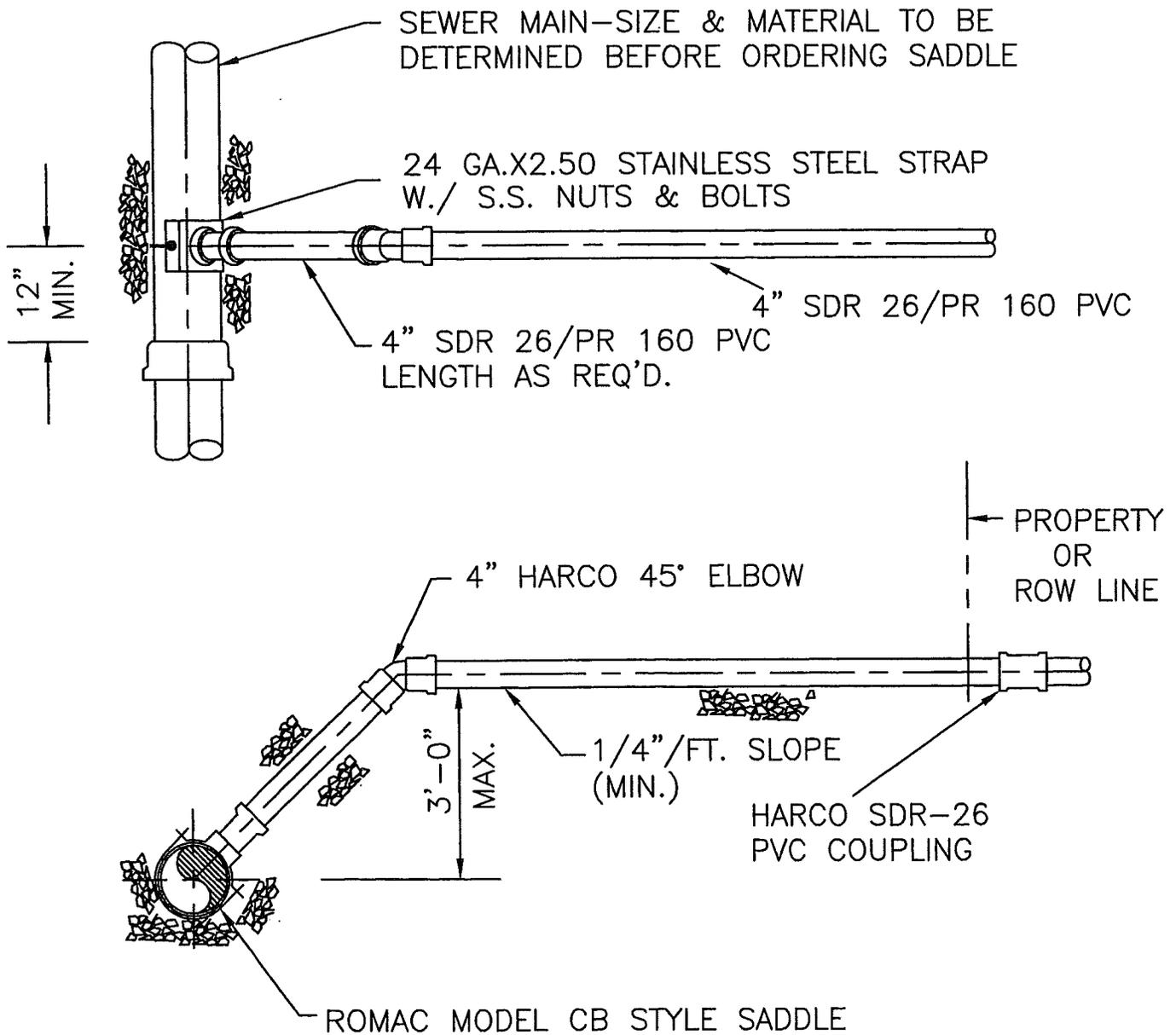
1. CONNECTION FROM INSPECTION MANHOLE SHALL BE IN ACCORDANCE WITH TOWNSHIP PLUMBING CODE



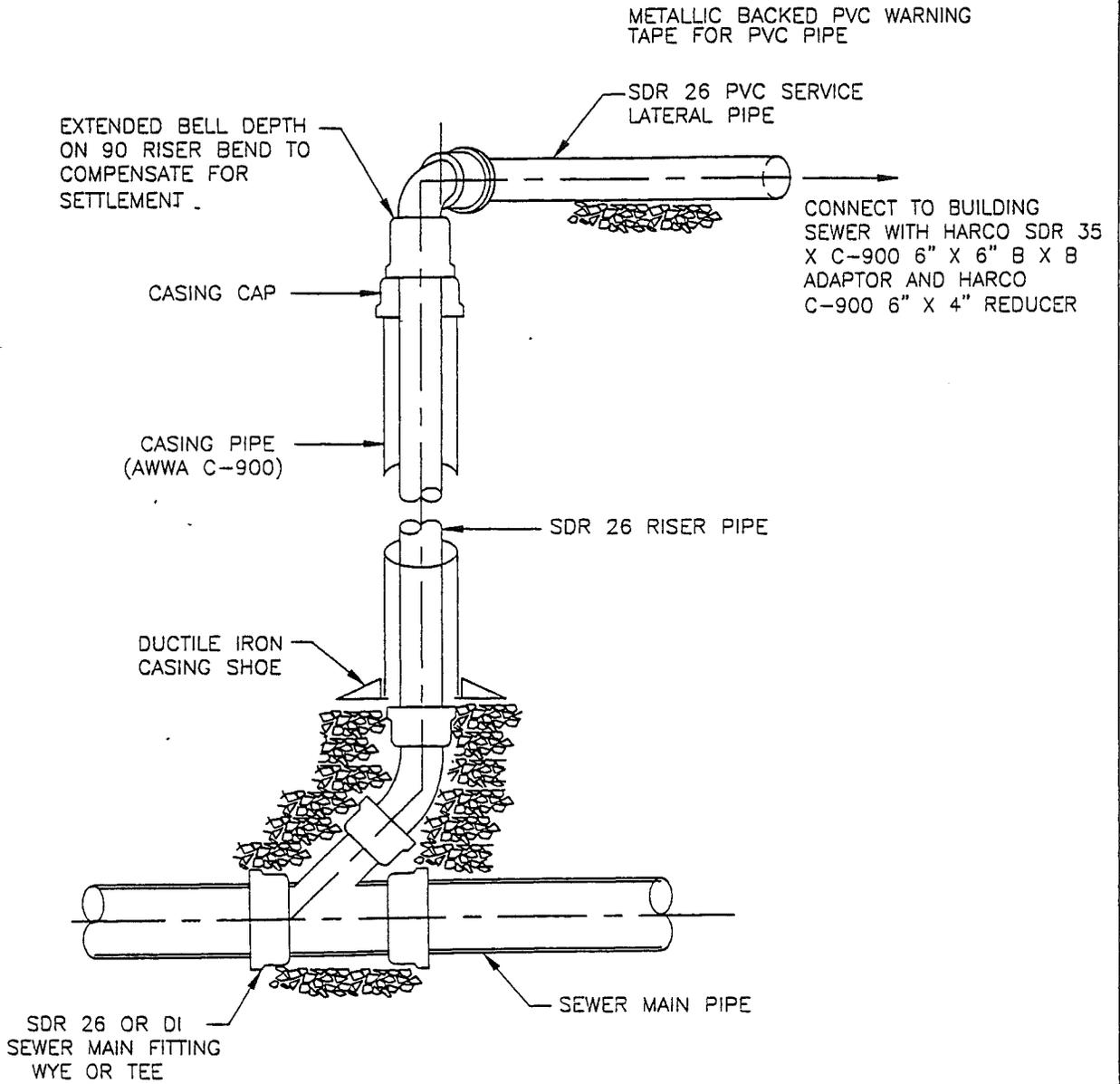
TYPICAL LATERAL DETAIL
FOR INDUSTRIAL / COMMERCIAL CONNECTION

NOTES:

1. HOLE FOR SADDLE IN SEWER MAIN TO BE CORE DRILLED USING WHEELER REX HOLE CUTTER OR EQUAL. NO OTHER METHOD IS ACCEPTABLE.
2. CONCRETE ENCASEMENT OF SADDLE TO BE FIELD DETERMINED.
3. MAXIMUM CONNECTION SIZE SHALL BE TWO (2) PIPE DIAMETERS SMALLER THAN THE SEWER MAIN.
4. EXTRACTED "COUPON" TO BE GIVEN TO THE OWNER.



LATERAL CONNECTION WITH SADDLE

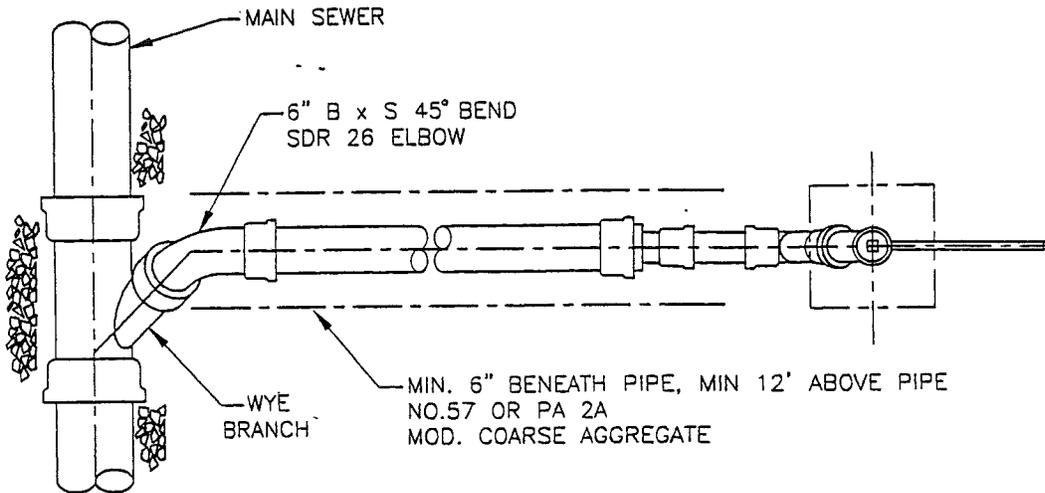


THE RISER SECTION OF THE LATERAL SHALL BE A "B & H" RISER OR APPROVED EQUAL

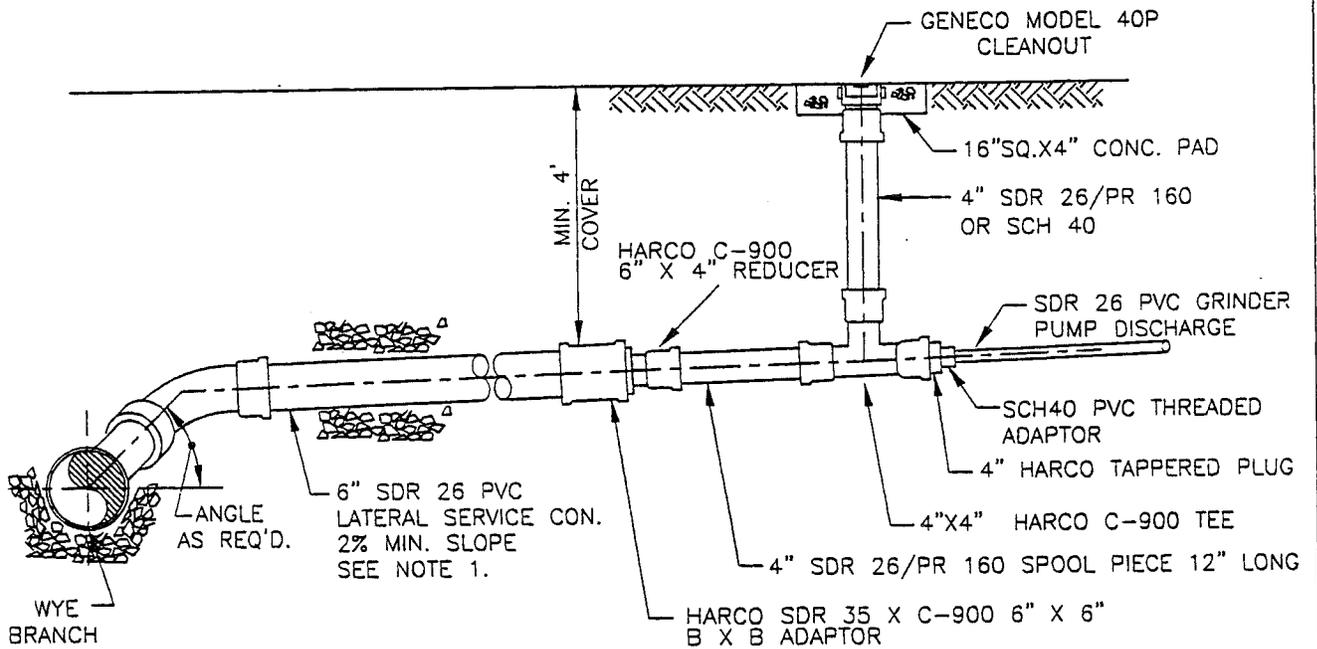
DEEP CUT LATERAL

NOTES:

1. IF THE SEWER MAIN IS 8" AND A SADDLE IS REQUIRED FOR THE CONNECTION, THE LATERAL PIPE SIZE SHALL BE REDUCED TO 4".
2. IF CURBING OR PAVING DOES NOT EXIST, LATERAL SHALL BE 10 FEET IN LENGTH OR FOUR (4') FEET PAST THE EDGE OF THE RIGHT-OF-WAY, WHICHEVER IS GREATER.



PLAN



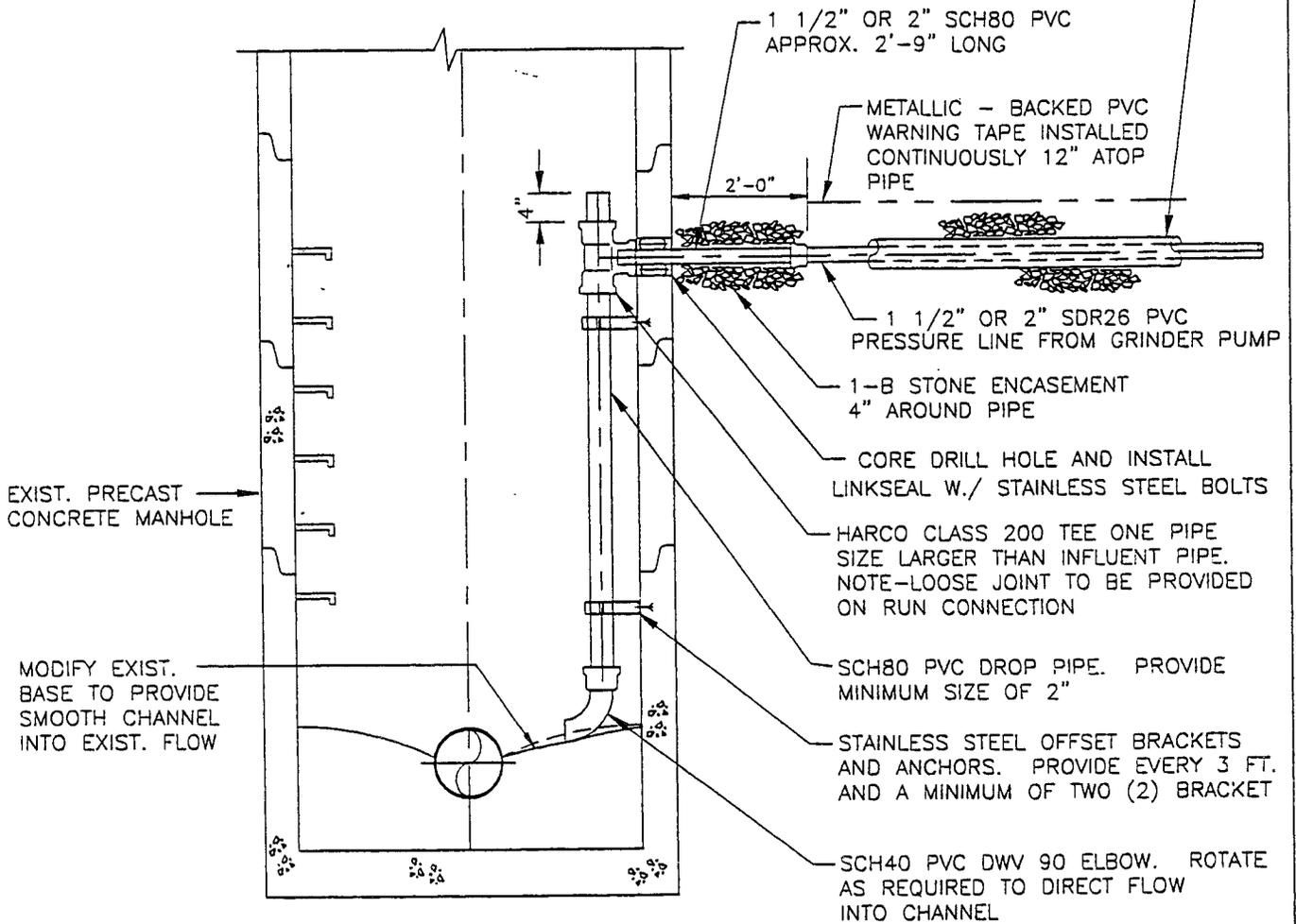
SECTION

GRINDER PUMP DISCHARGE
CONNECTION TO SEWER MAIN

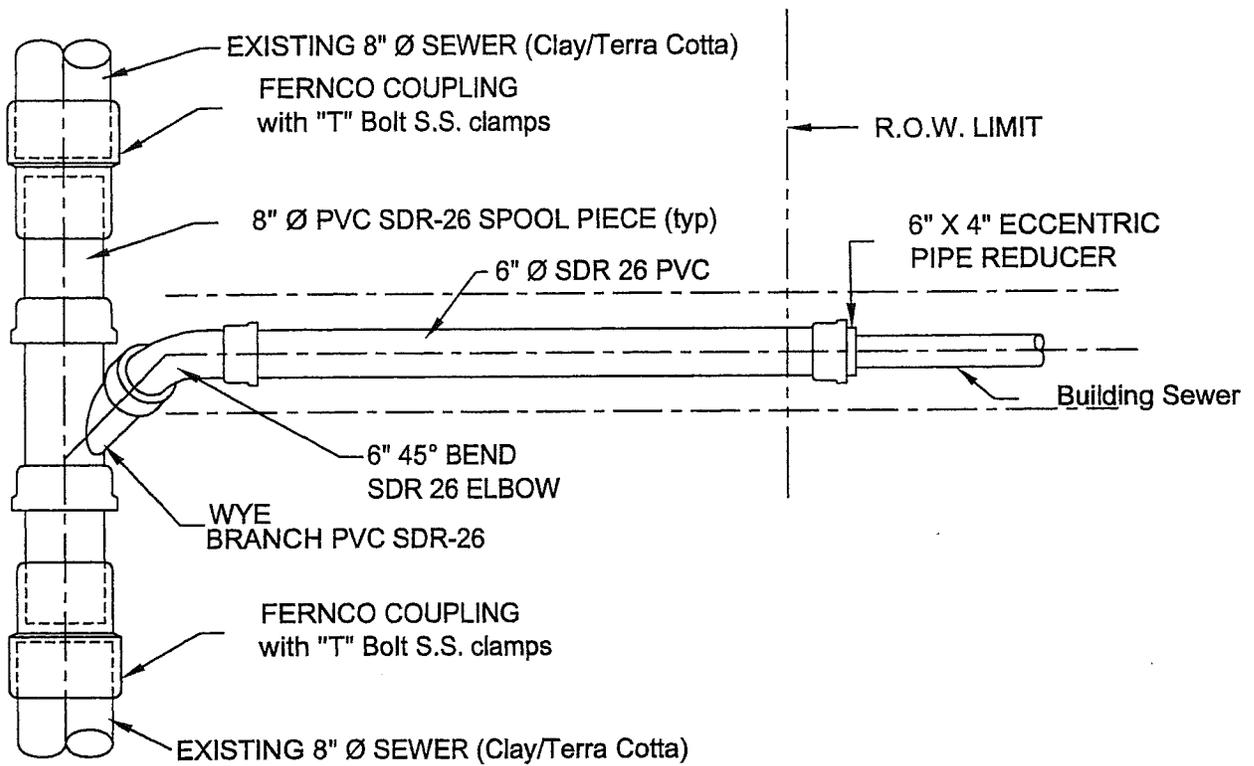
NOTES:

1. AN INSIDE DROP CONNECTION WILL NOT BE REQUIRED IF THE INVERT OF THE PRESSURE PIPE IS WITHIN 4" OF THE TOP OF THE EXISTING BENCHING. PROVIDE AN ELBOW INSIDE MANHOLE AS REQUIRED TO MINIMIZE SPLASHING AND A SMOOTH CHANNEL INTO EXISTING FLOW.

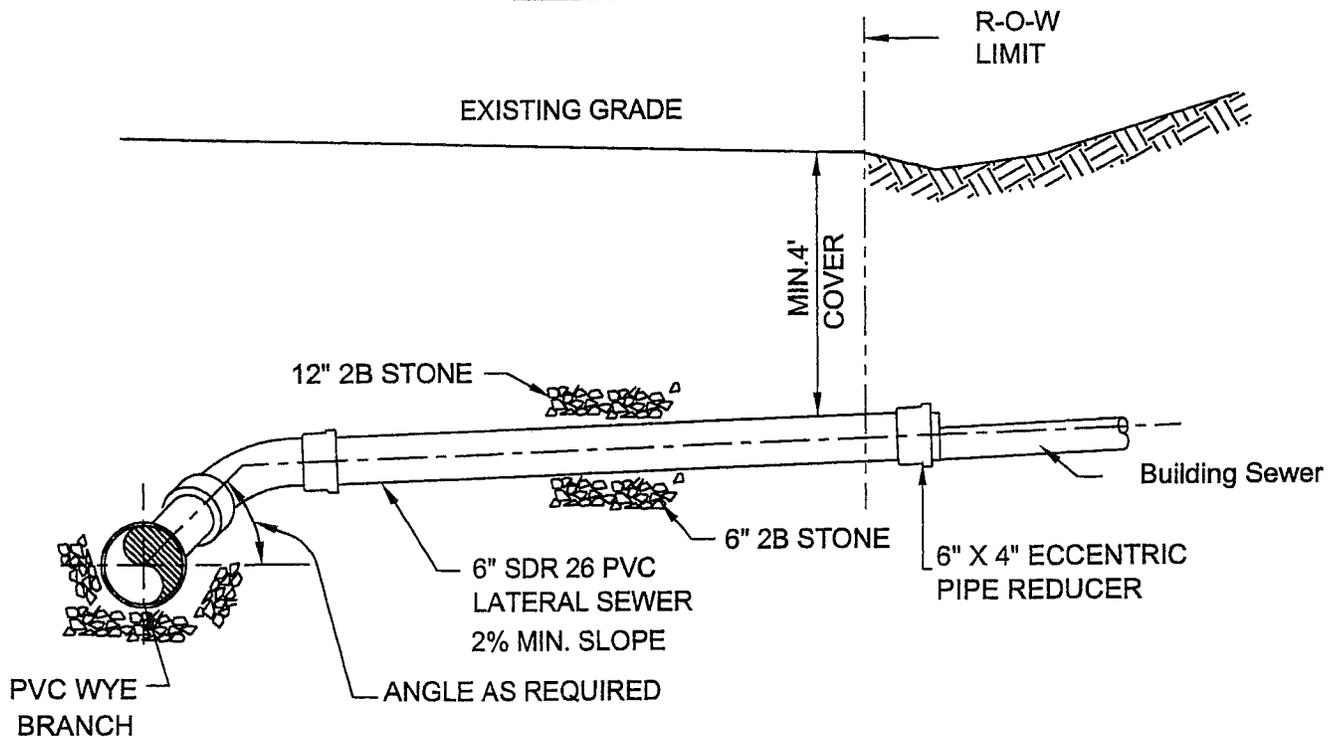
CAST IRON CASING IN PAVED AREA TO BE EVALUATED ON CASE BY CASE BASIS. SLEEVE TO PENETRATE MANHOLE WALL. HOLE TO BE COREDRILLED AND LINKSEAL PROVIDED. SUPPORT CARRIER PIPE EVERY 6 FT. WITH LINKSEAL



GRINDER PUMP FORCE MAIN
CONNECTION TO MANHOLE

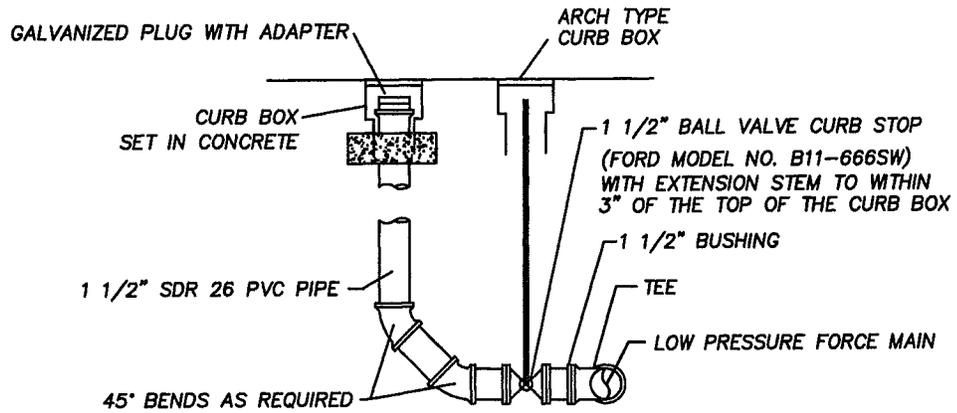


PLAN

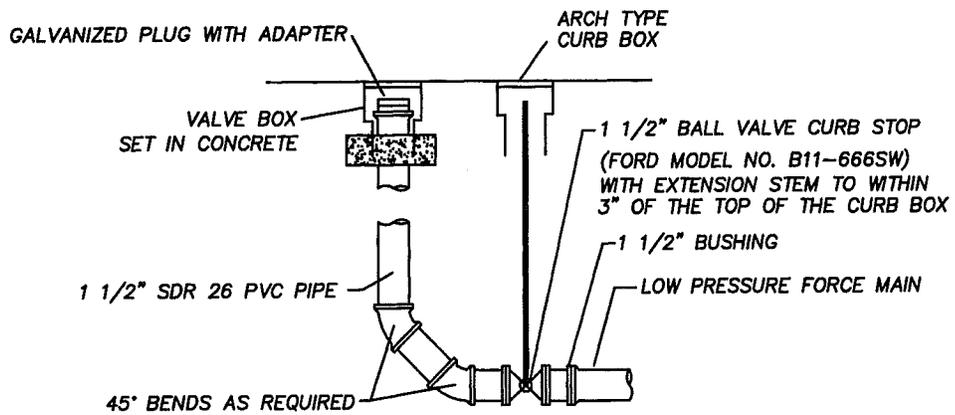


SECTION

LATERAL CONNECTION TO EXISTING CLAY OR TERRA COTTA SEWER MAIN

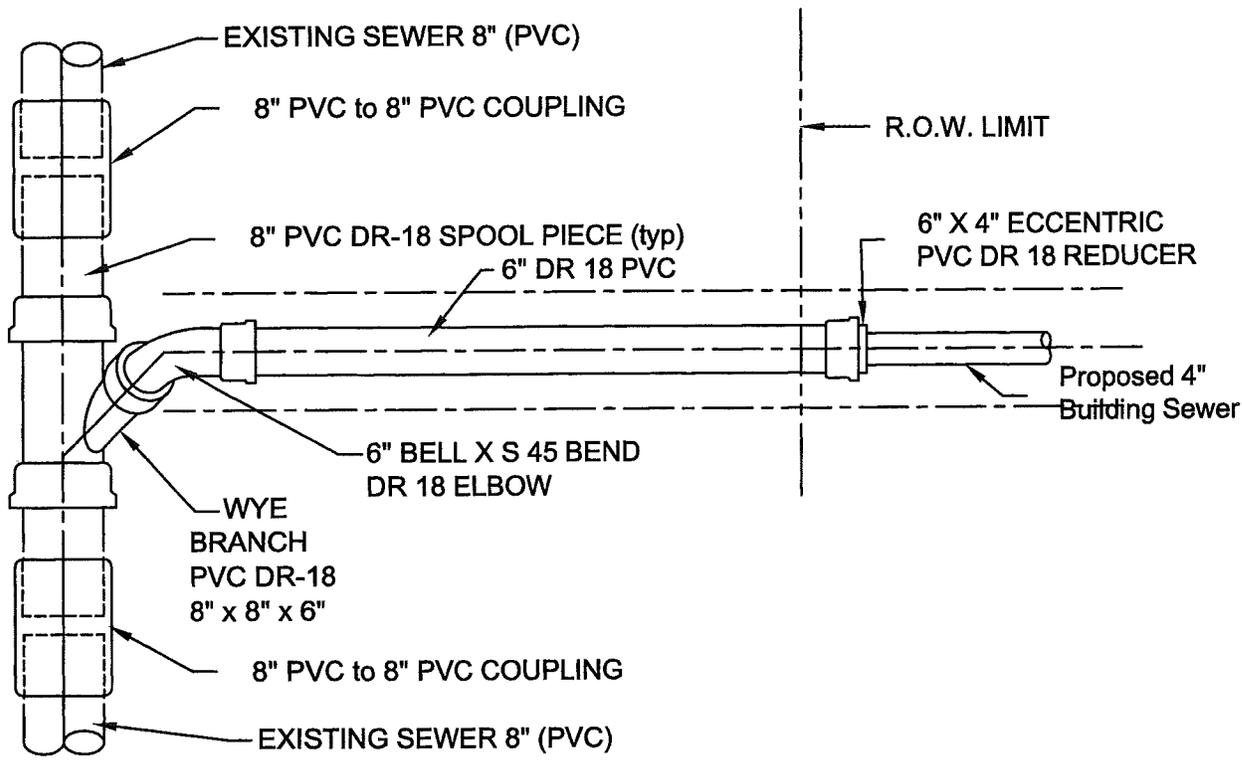


1 1/2" FORCE MAIN
IN LINE FLUSHING STATION

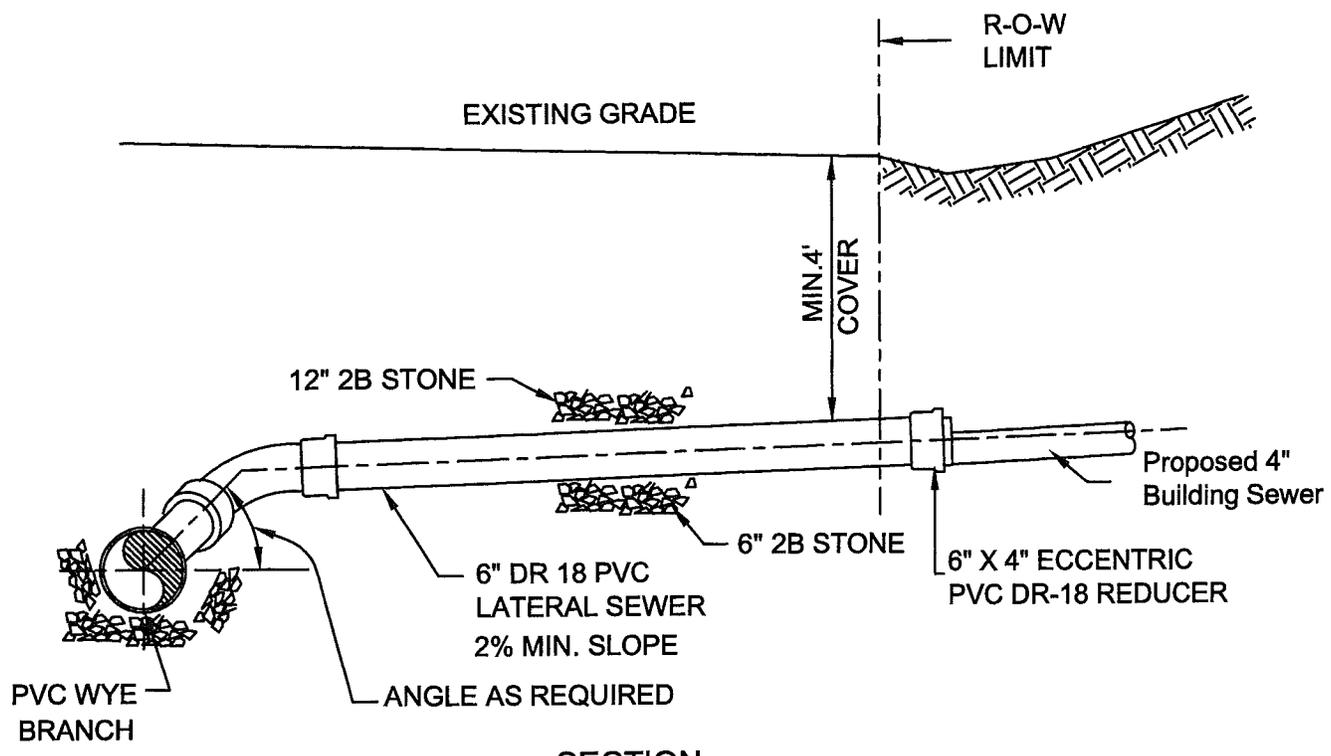


1 1/2" FORCE MAIN
END LINE FLUSHING STATION

FORCE MAIN END FLUSHING CONNECTIONS



PLAN

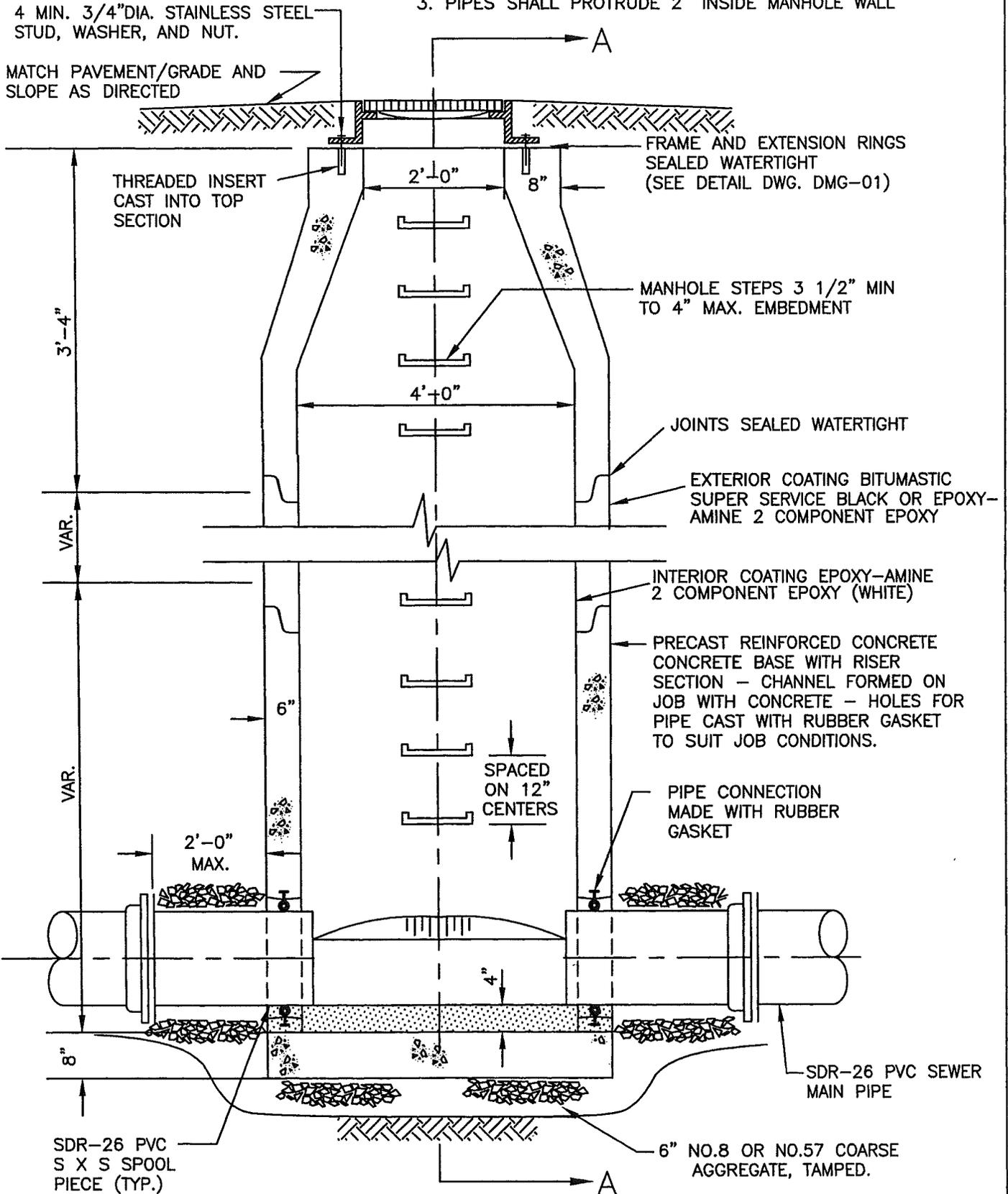


SECTION

LATERAL CONNECTION TO EXISTING PVC SEWER MAIN

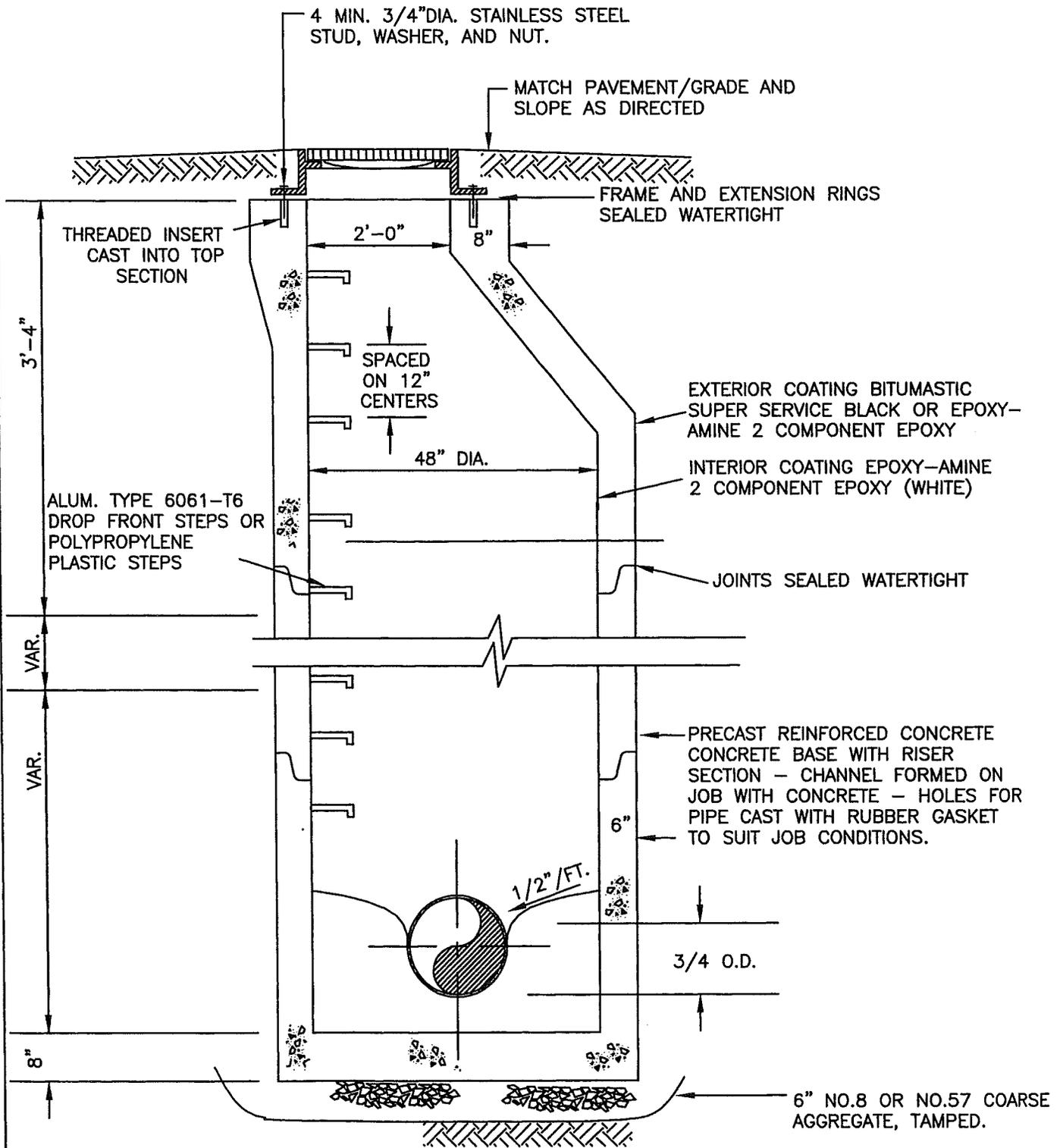
NOTES:

1. BOLTING OF MANHOLE FRAME AND COVER NOT REQUIRED FOR MANHOLES INSTALLED IN PAVED SURFACES
2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION
3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL



**PRECAST CONCRETE MANHOLE
W./ PRECAST CONCRETE BASE**

- NOTE: 1. BOLTING OF MANHOLE FRAME AND COVER NOT REQUIRED FOR MANHOLES INSTALLED IN PAVED SURFACES.
 2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.
 3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL.



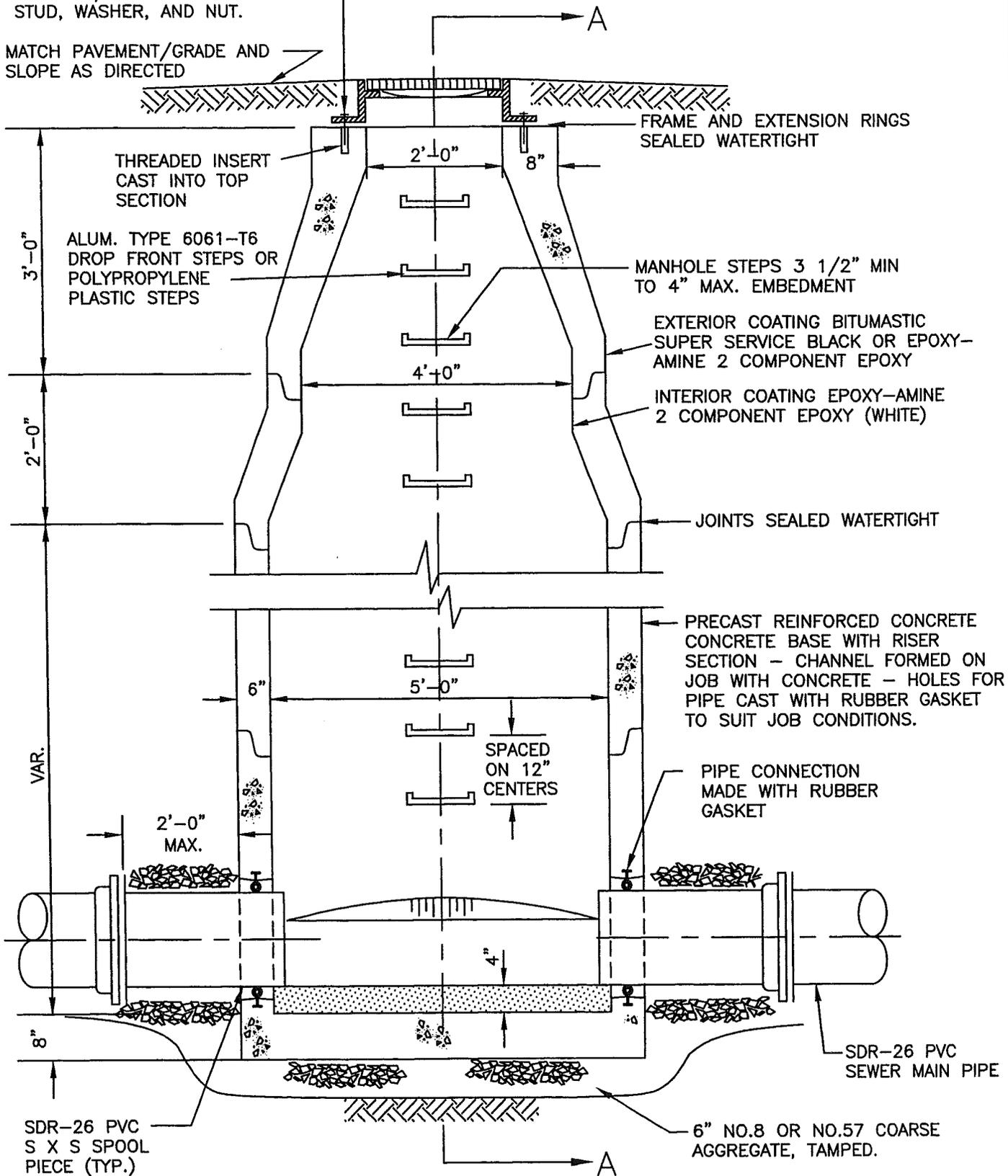
SECTION A-A
 PRECAST CONCRETE MANHOLE
 W./ PRECAST CONCRETE BASE

NOTES:

1. BOLTING OF MANHOLE FRAME AND COVER NOT REQUIRED FOR MANHOLES INSTALLED IN PAVED SURFACES
2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION
3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL

4 MIN. 3/4" DIA. STAINLESS STEEL STUD, WASHER, AND NUT.

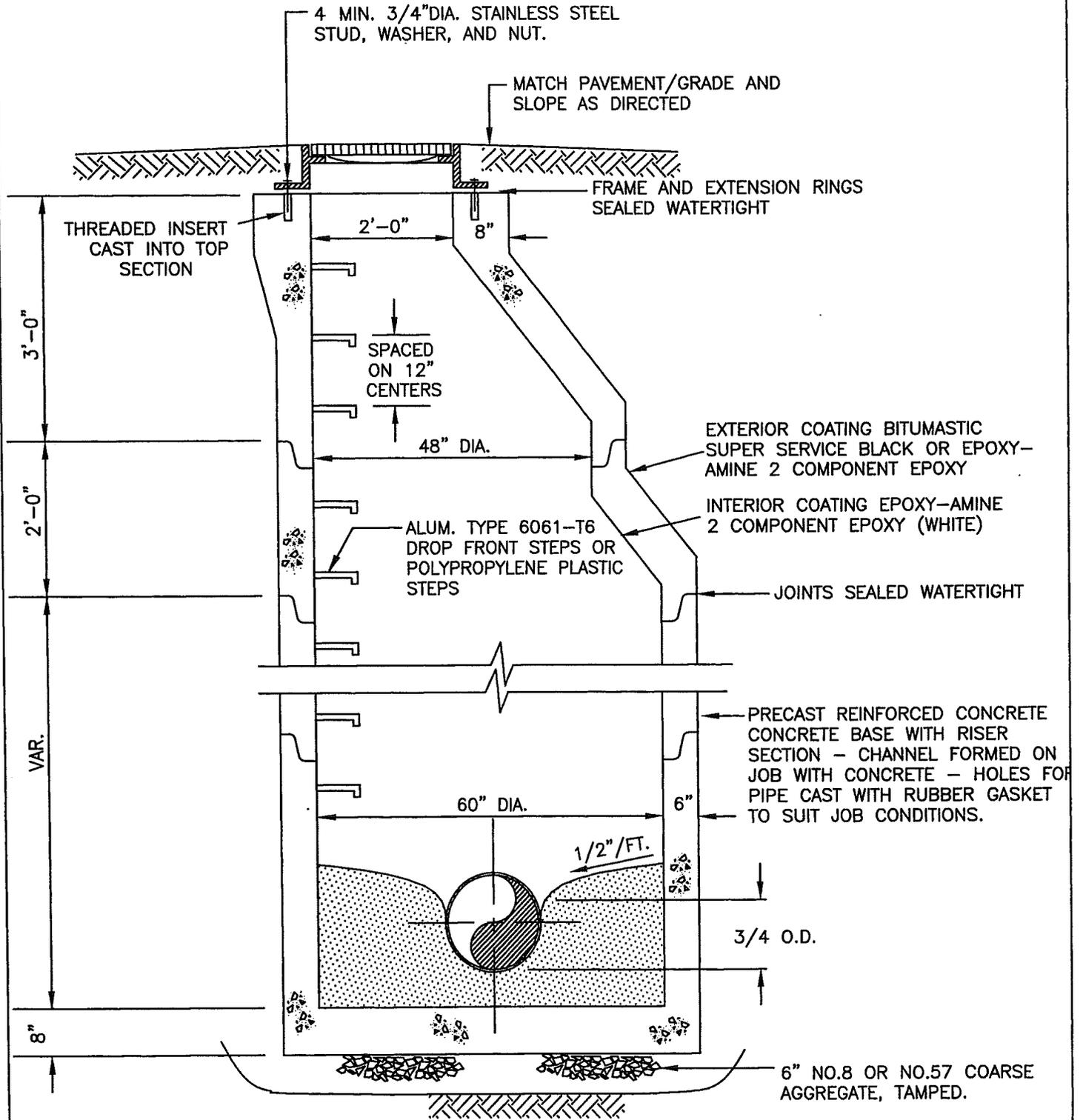
MATCH PAVEMENT/GRADE AND SLOPE AS DIRECTED



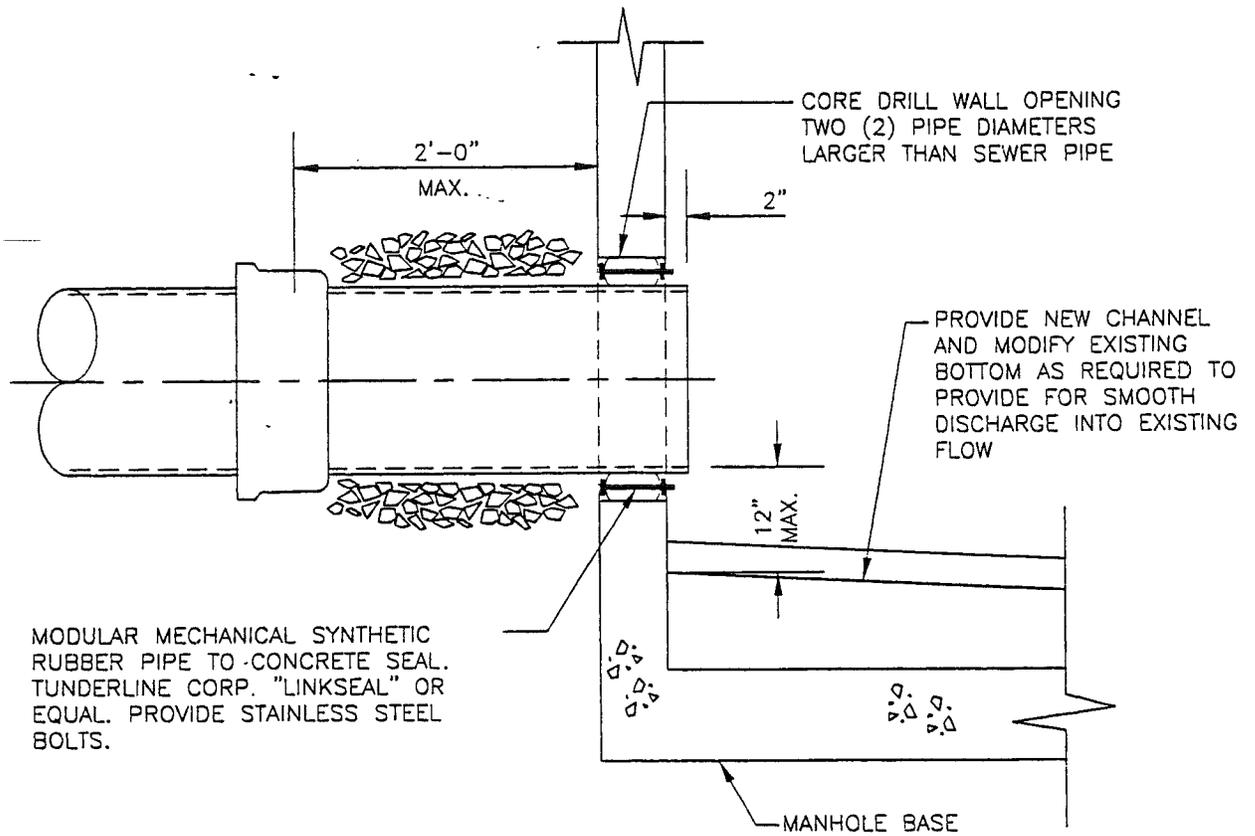
PRECAST CONCRETE 5' MANHOLE

W./ PRECAST CONCRETE BASE

- NOTE: 1. BOLTING OF MANHOLE FRAME AND COVER NOT REQUIRED FOR MANHOLES INSTALLED IN PAVED SURFACES.
 2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.
 3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL.



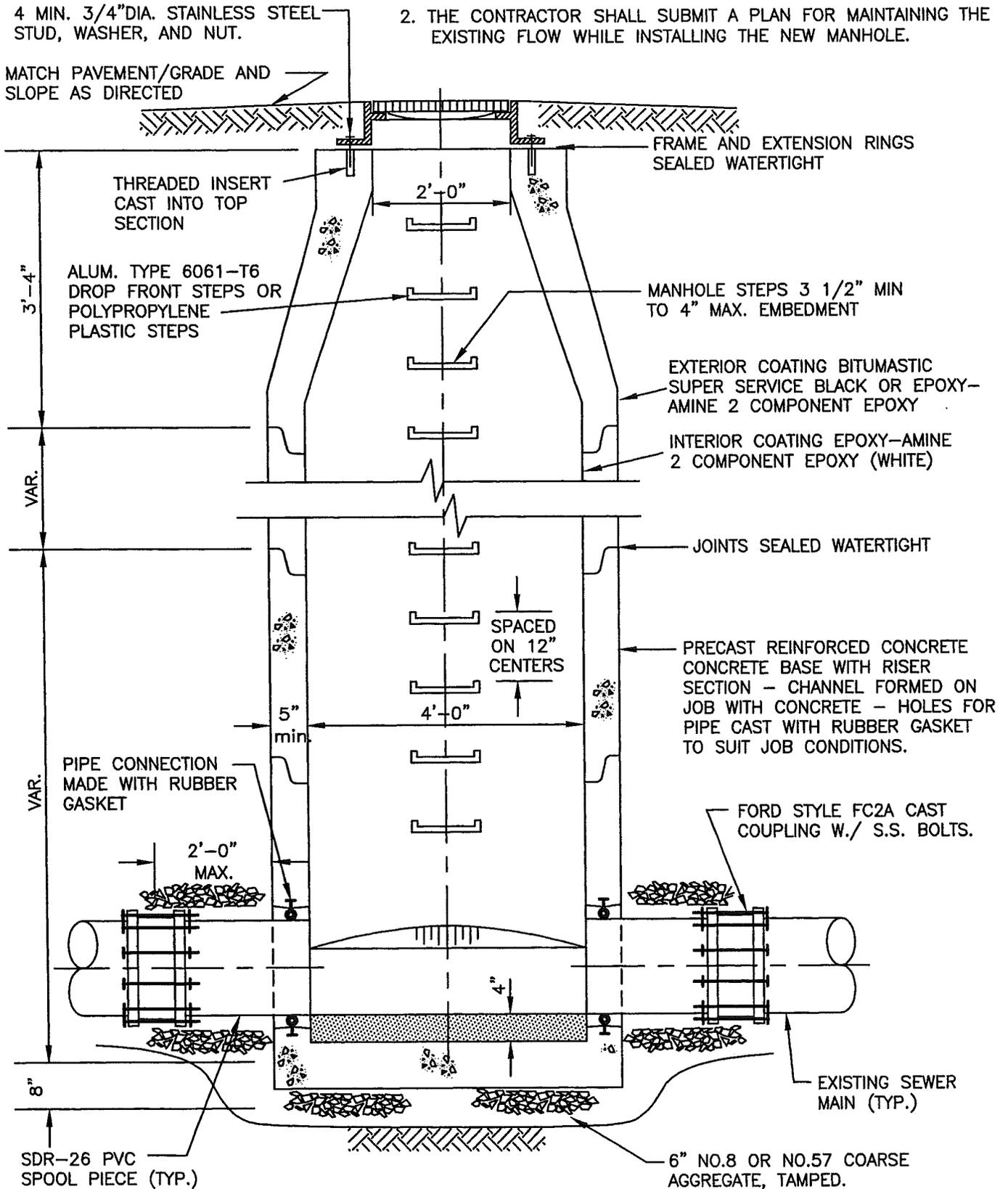
SECTION A-A
**PRECAST CONCRETE 5' MANHOLE
 W./ PRECAST CONCRETE BASE**



PIPE CONNECTION TO AN EXISTING
MANHOLE

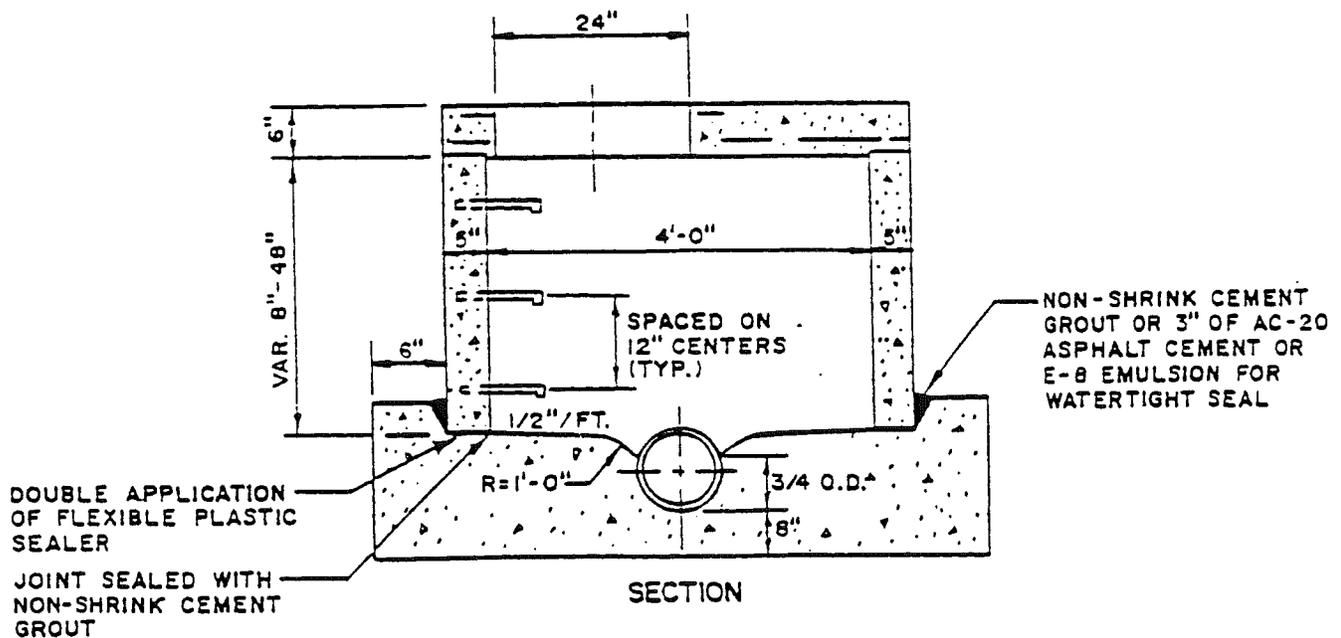
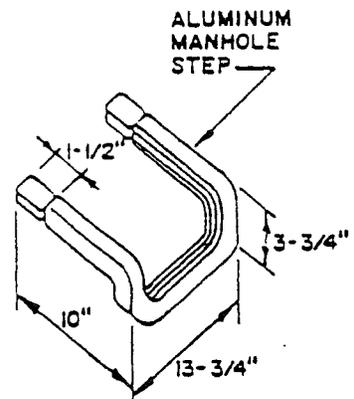
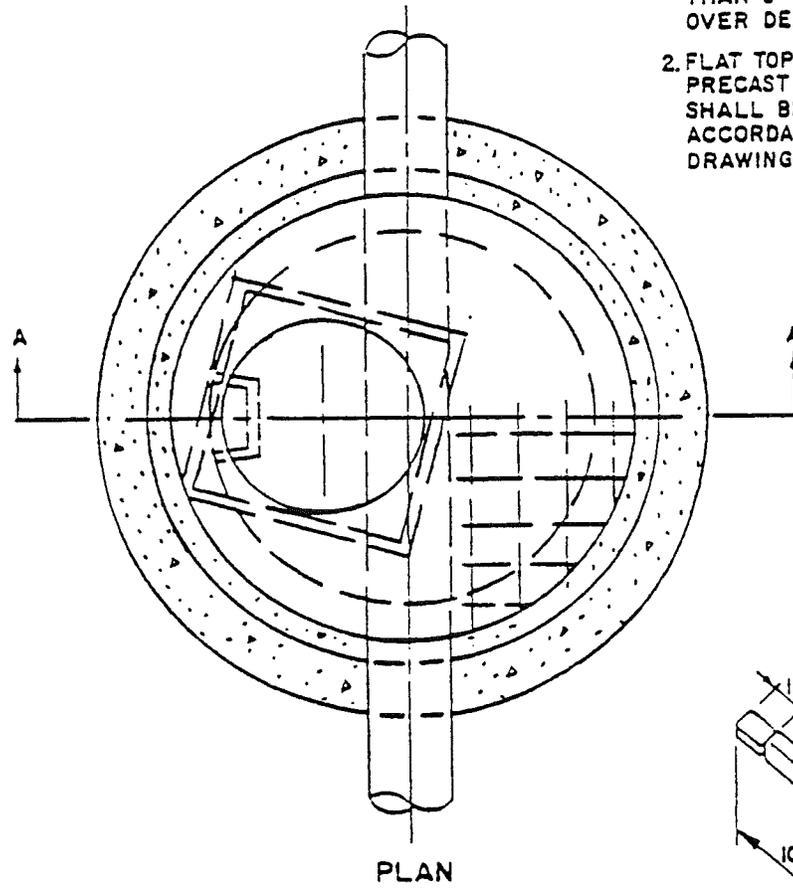
NOTES:

1. PRIOR TO INSTALLATION OF MANHOLE THE CONTRACTOR SHALL TEST DIG AND DETERMINE THE O.D. AND OVALITY OF THE EXISTING PIPE.
2. THE CONTRACTOR SHALL SUBMIT A PLAN FOR MAINTAINING THE EXISTING FLOW WHILE INSTALLING THE NEW MANHOLE.



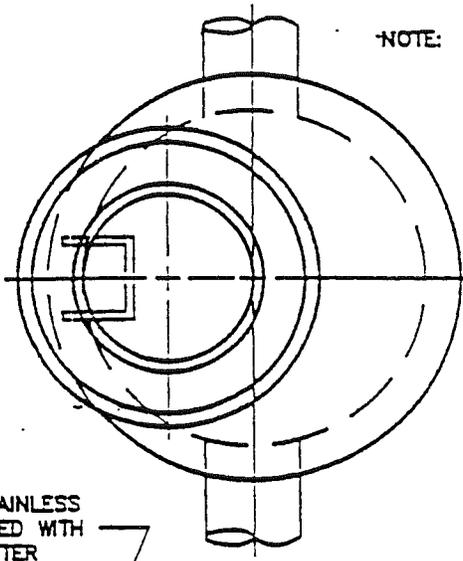
INSERTION OF A PRECAST CONCRETE MANHOLE INTO AN EXISTING SEWER MAIN

- NOTE: 1. USE FLAT SLAB TOPS ON MANHOLES FOR CONNECTING SEWER LINES HAVING LESS THAN 5' DEPTH OF COVER OVER DEEPEST PIPE.
2. FLAT TOP MANHOLES WITH PRECAST CONCRETE BASE SHALL BE CONSTRUCTED IN ACCORDANCE WITH DETAIL DRAWINGS DM-01 AND DM-02

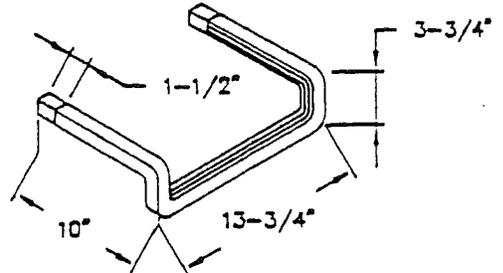


PRECAST CONCRETE SHALLOW MANHOLE WITH
FLAT TOP AND Poured MONOLITHIC CONC. BASE

- NOTE:
1. BOLTING OF MANHOLE FRAME AND COVER NOT REQUIRED FOR MANHOLES INSTALLED IN PAVED SURFACES.
 2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.
 3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL.

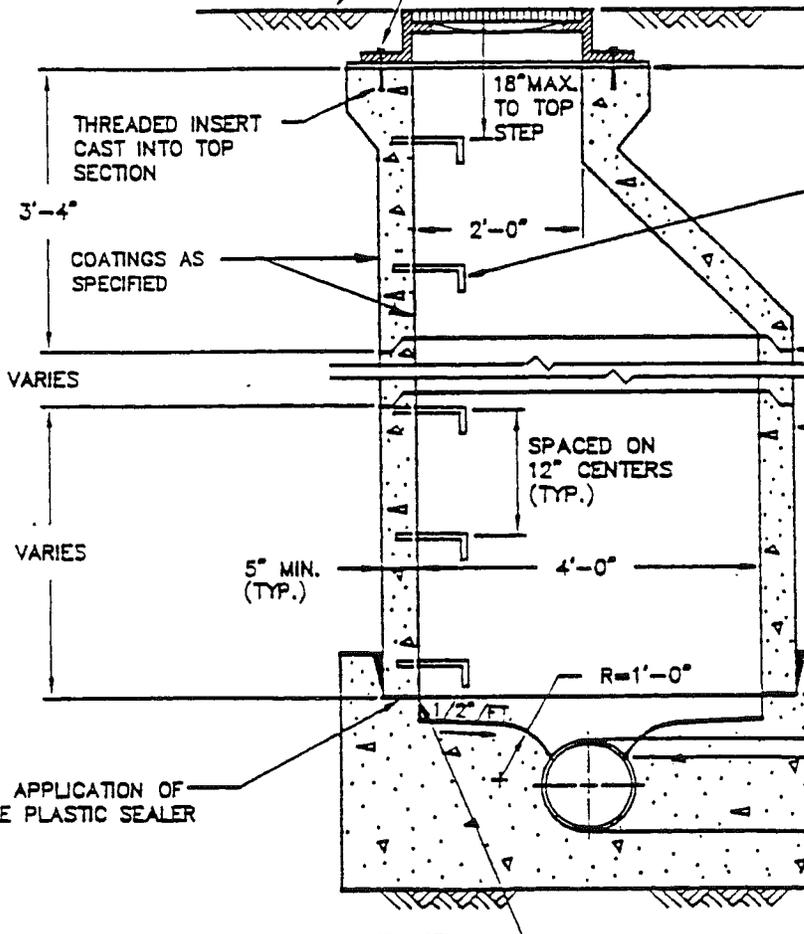


PLAN



4" MIN. 3/4" DIA. GALVANIZED OR STAINLESS STEEL STUD, WASHER, AND NUT COATED WITH ONE COAT OF STANDARD ASPHALT AFTER INSTALLATION.

MATCH PAVEMENT/GRADE AND SLOPE AS DIRECTED



SECTION

FRAME AND LEVELING RINGS SEALED WATERTIGHT (SEE DETAIL DWG. DMG-01)

ALUMINUM MANHOLE STEPS ALCOA NO. 15785 3-1/2" MIN. TO 4" MAX. EMBEDMENT.

JOINTS SEALED WATERTIGHT (SEE DETAIL DWG. DMG-01)

PRECAST REINFORCED CONCRETE SECTION

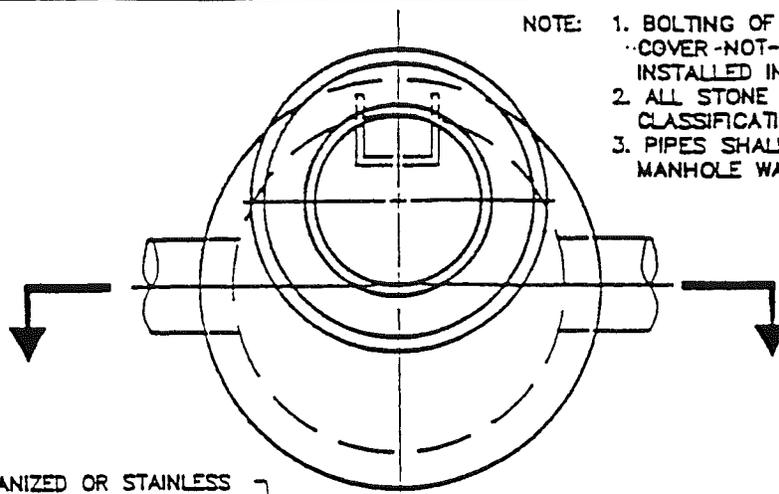
NON-SHRINK CEMENT GROUT OR 3" OF AC-20 ASPHALT CEMENT OR E-8 EMULSION FOR WATERTIGHT SEAL

DOUBLE APPLICATION OF FLEXIBLE PLASTIC SEALER

JOINT SEALED WITH NON-SHRINK CEMENT GROUT

PRECAST CONCRETE MANHOLE
W./ POURED MONOLITHIC CONCRETE BASE

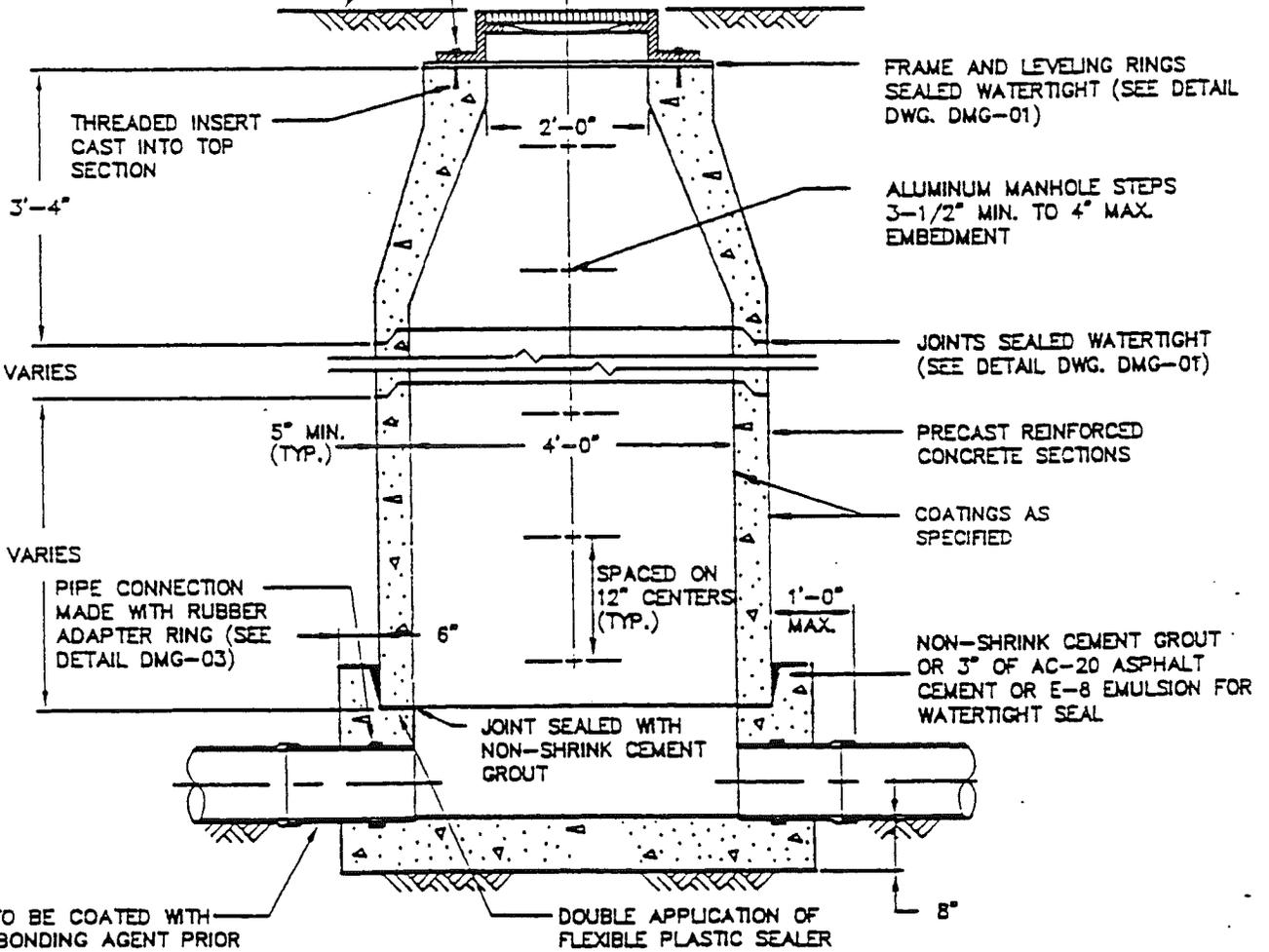
- NOTE:
1. BOLTING OF MANHOLE FRAME AND COVER - NOT REQUIRED - FOR MANHOLES INSTALLED IN PAVED SURFACES.
 2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.
 3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL.



4" MIN. 3/4" DIA. GALVANIZED OR STAINLESS STEEL STUD, WASHER, AND NUT COATED WITH ONE COAT OF STANDARD ASPHALT AFTER INSTALLATION.

MATCH PAVEMENT/GRADE AND SLOPE AS DIRECTED

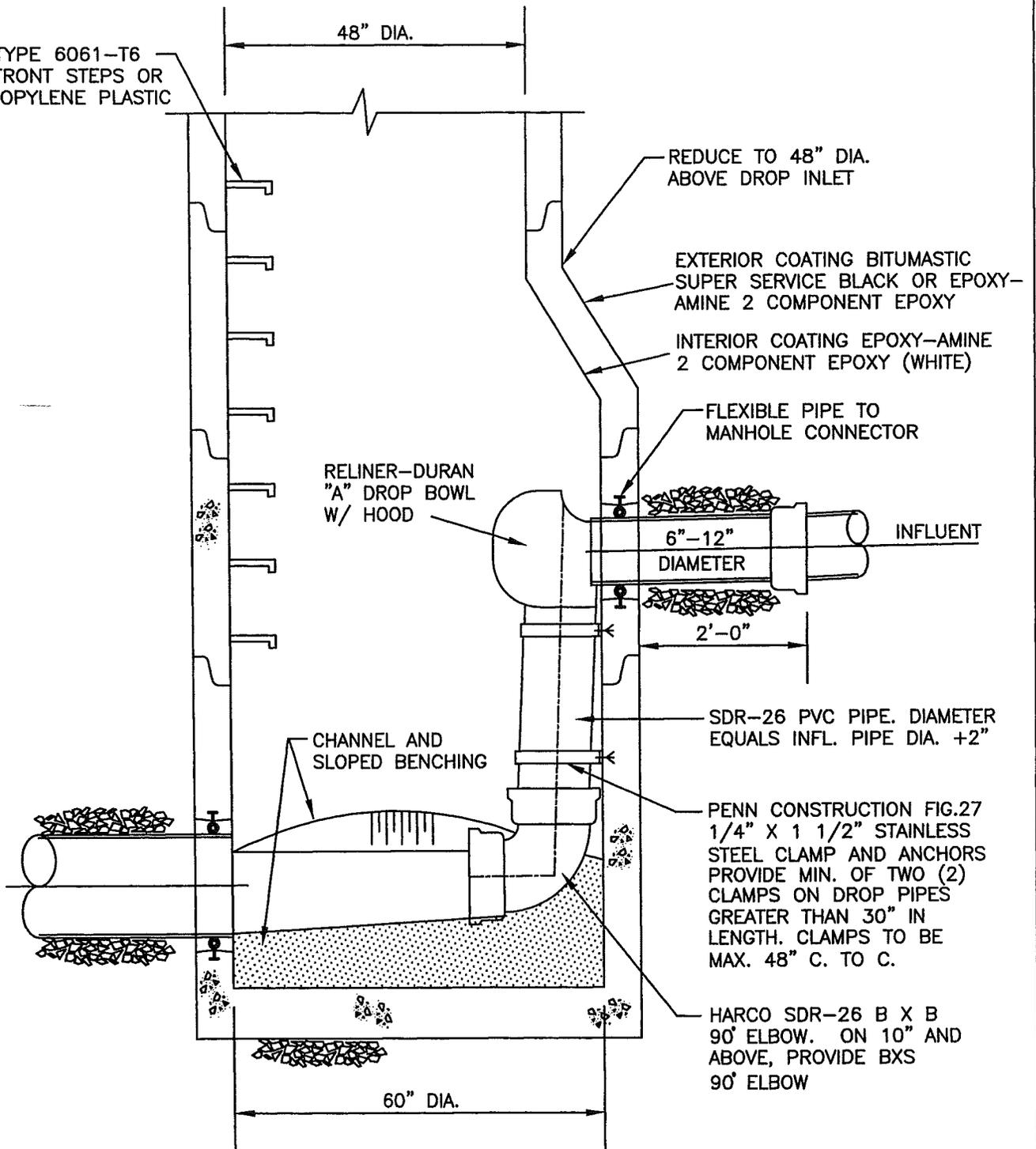
PLAN



SECTION

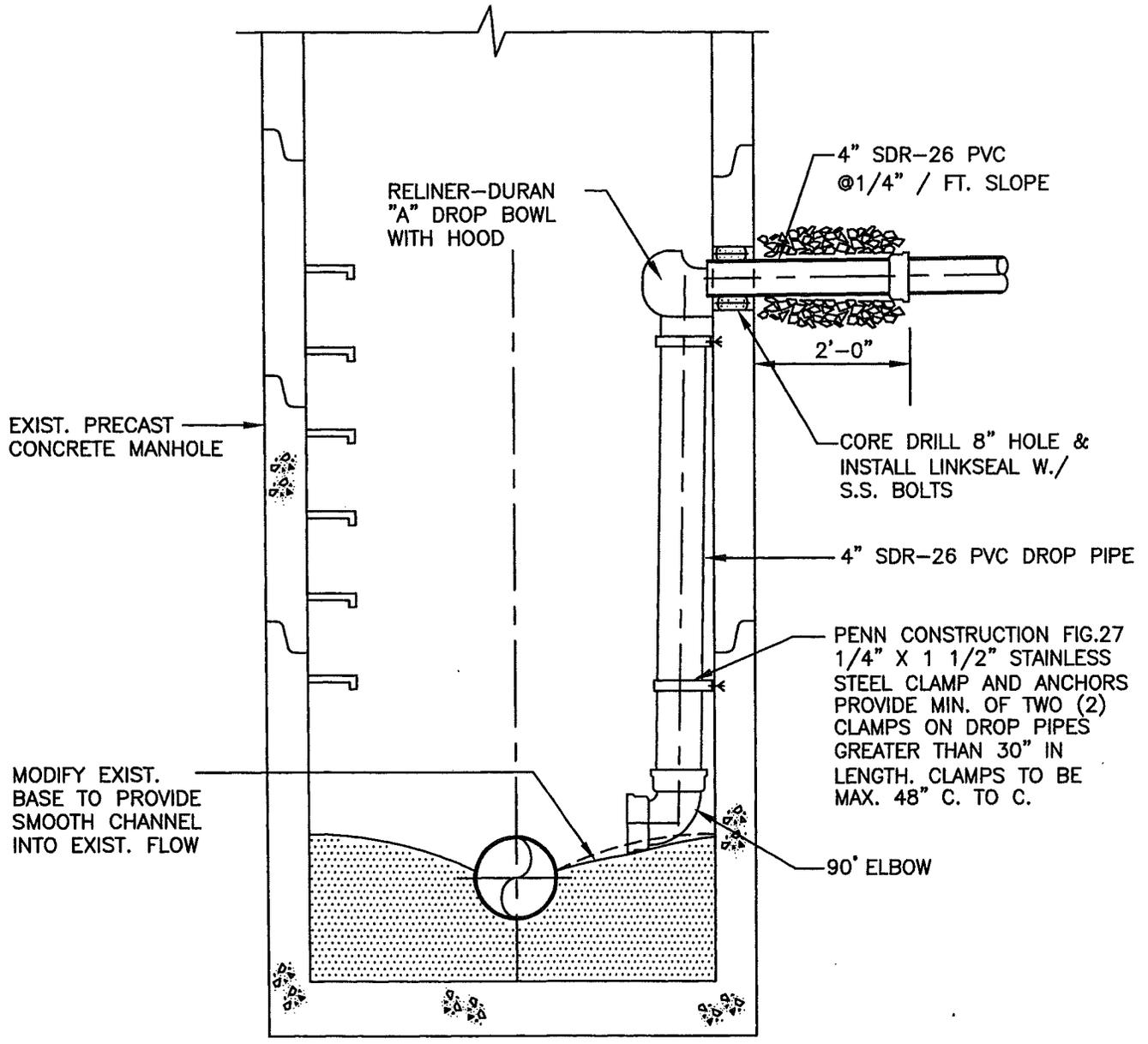
PRECAST CONCRETE MANHOLE
W./ POURED MONOLITHIC CONCRETE BASE
PIPE CONNECTION

ALUM. TYPE 6061-T6
DROP FRONT STEPS OR
POLYPROPYLENE PLASTIC
STEPS

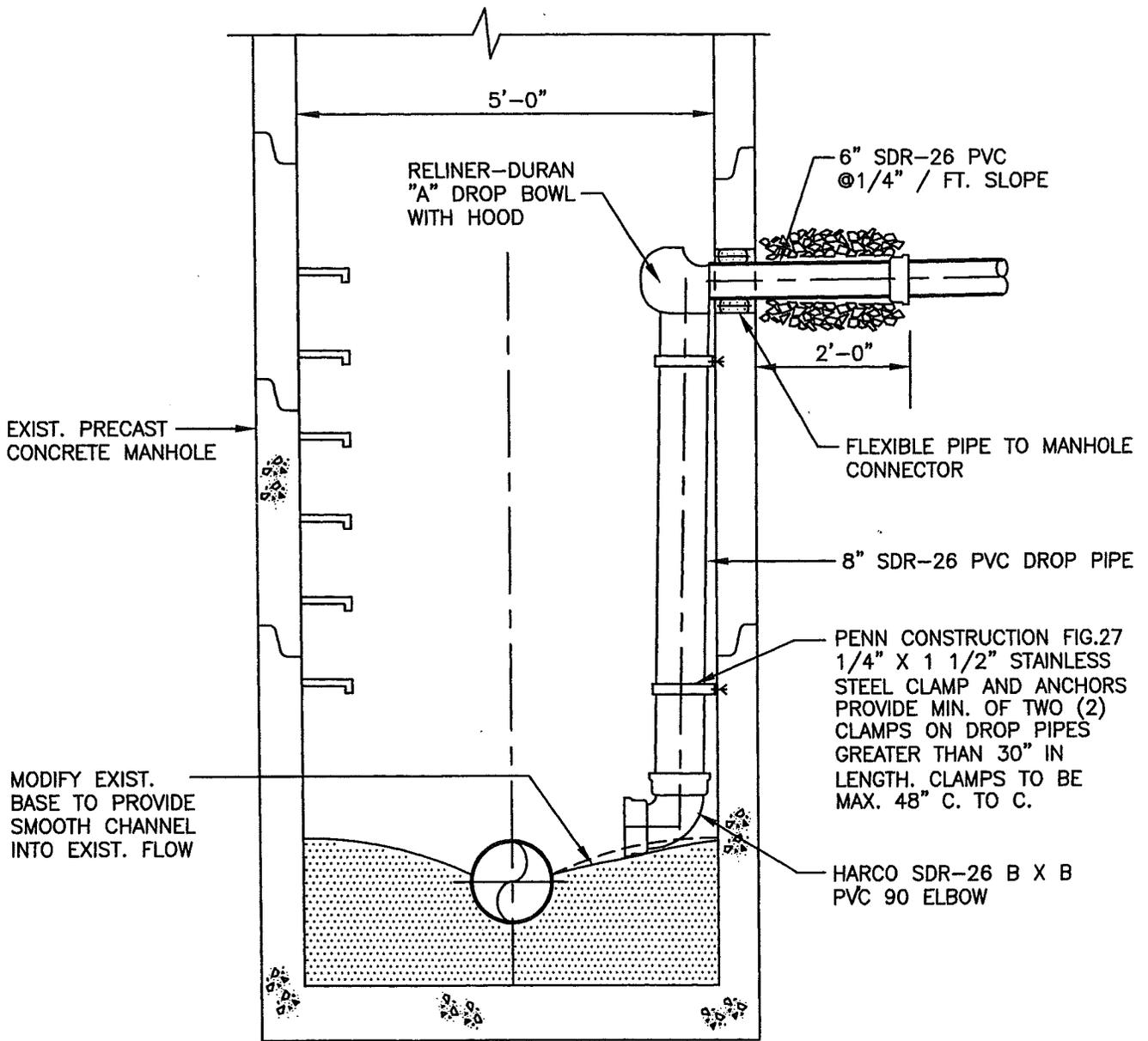


DROP MANHOLE

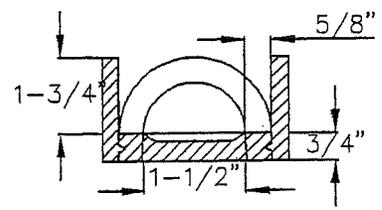
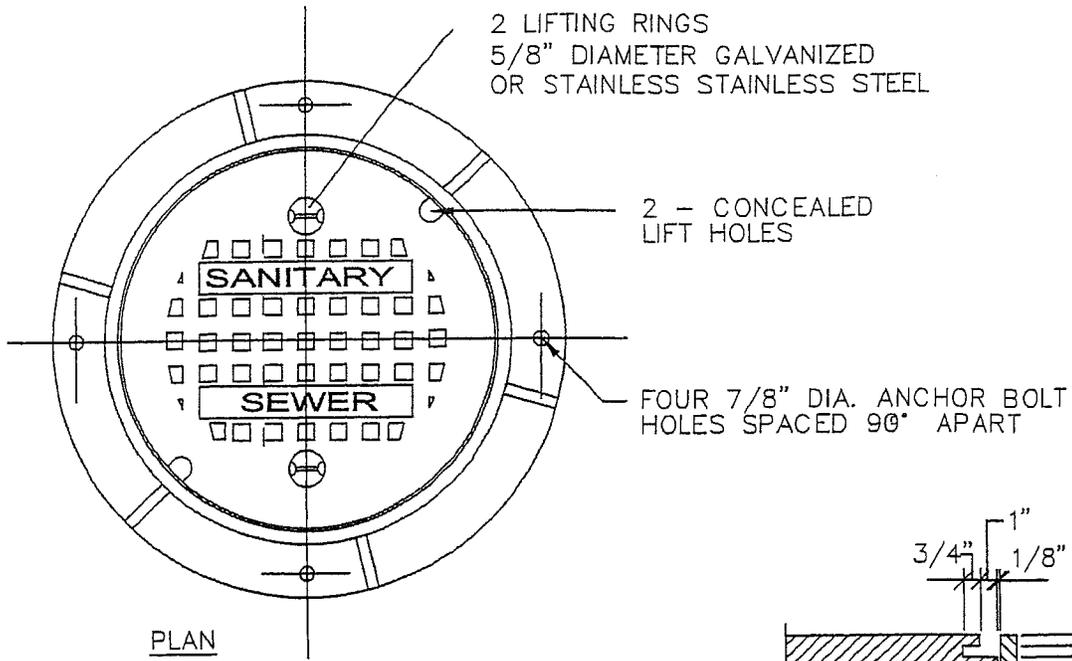
NOTE: INSIDE DROP PIPES NOT REQUIRED WHEN THE DISTANCE BETWEEN THE INVERT OF THE LATERAL AND THE CROWN OF THE EXISTING SEWER IS LESS THAN 15".



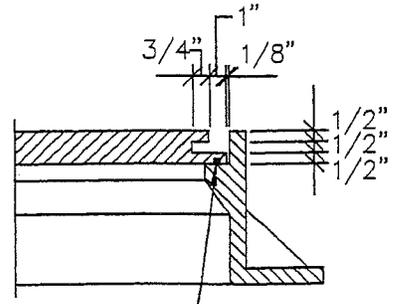
4" LATERAL CONNECTION TO EXISTING MANHOLE



LATERAL CONNECTION TO MANHOLE

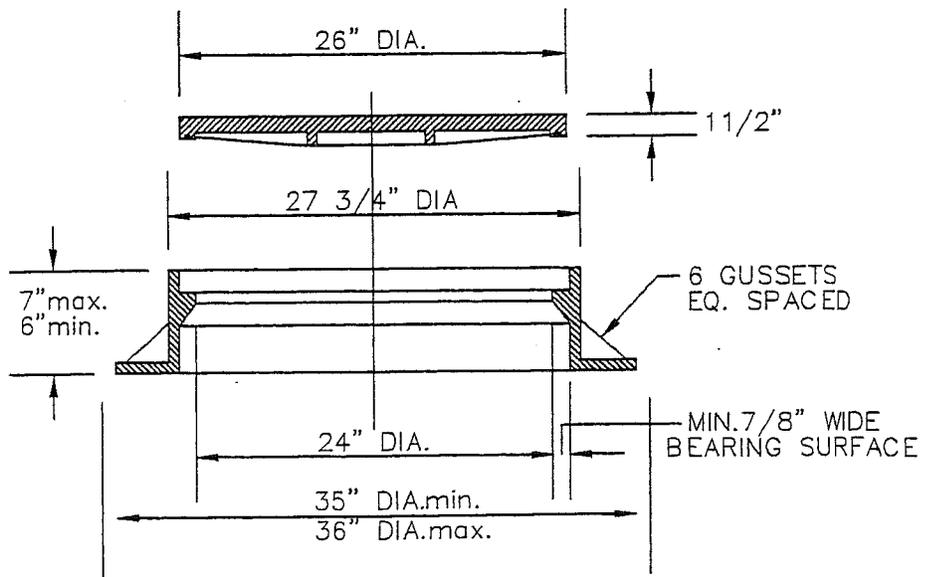


DETAIL-LIFTING RING



MACHINED DOVETAIL GROOVE WITH
1/4" CONTINUOUS POLYISOPRENE RUBBER
GASKET CENTERED ON BEARING SURFACE

SECTION THRU CONCEALED
PICKHOLE



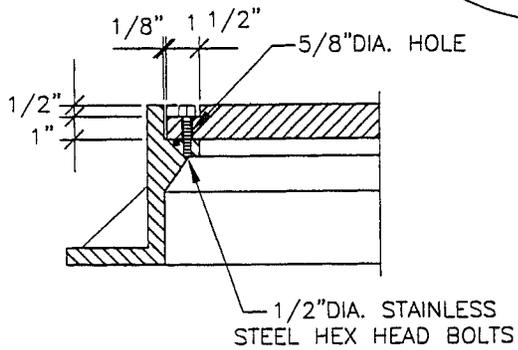
SECTION

HEAVY DUTY CAST IRON MANHOLE
FRAME AND SELF-SEALING COVER

2 LIFTING RINGS
5/8" DIAMETER GALVANIZED
OR STAINLESS STEEL

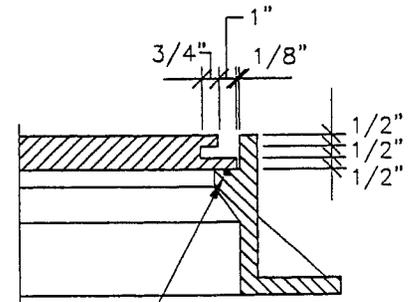
2 - CONCEALED
LIFT HOLES

FOUR 7/8" DIA. ANCHOR BOLT
HOLES SPACED 90° APART



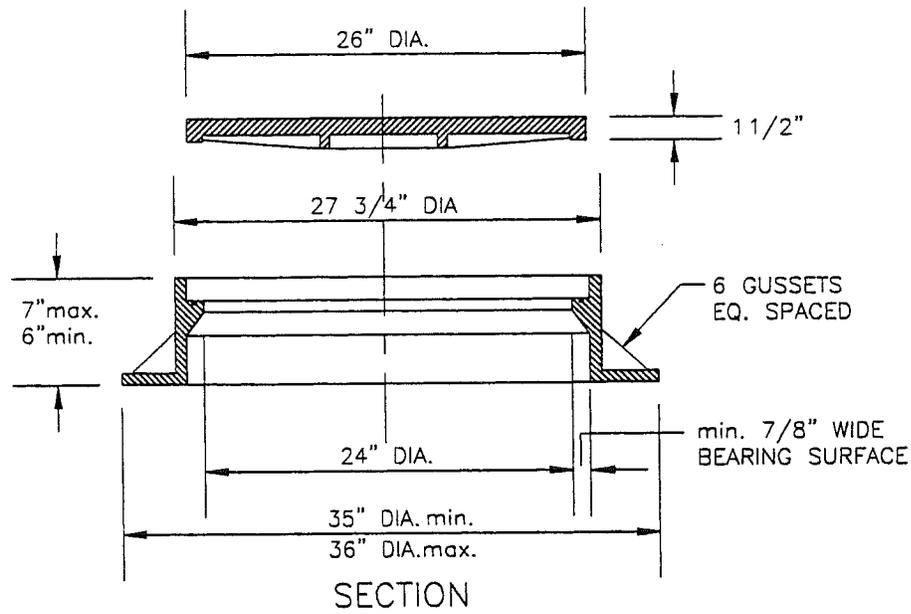
PLAN

MACHINED DOVETAIL GROOVE WITH
1/4" CONTINUOUS POLYISOPRENE RUBBER
GASKET CENTERED ON BEARING SURFACE

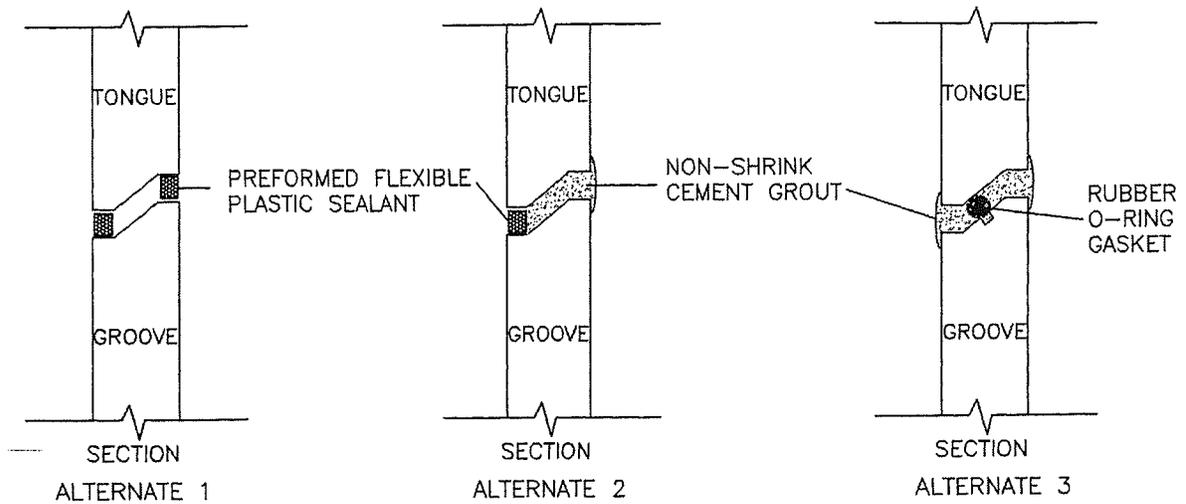


SECTION THRU BOLTS

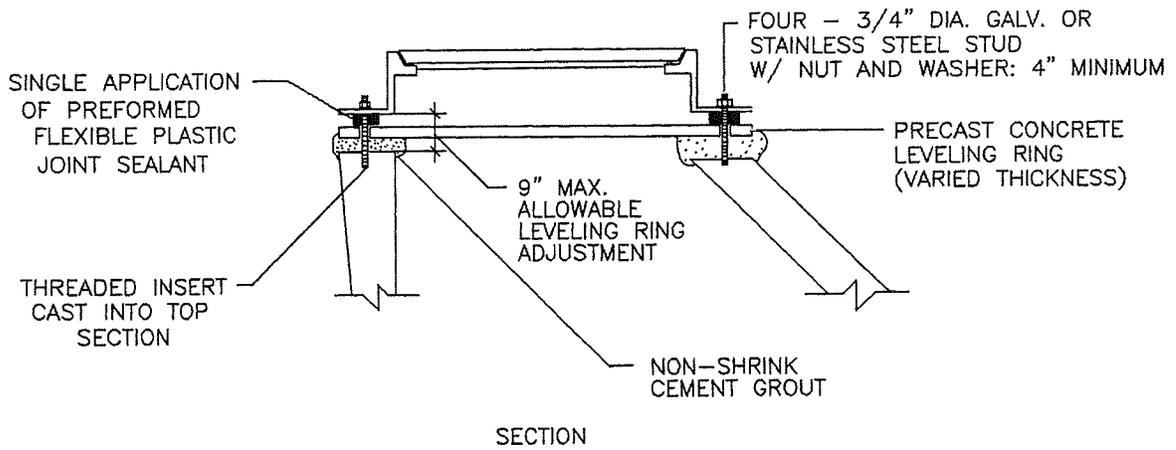
SECTION THRU CONCEALED
PICKHOLE



CAST IRON WATERTIGHT MANHOLE
FRAME AND COVER



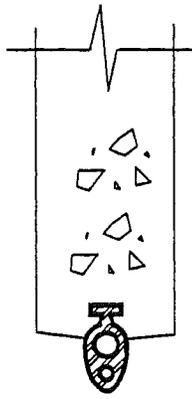
PRECAST CONCRETE
MANHOLE SECTION GASKETS



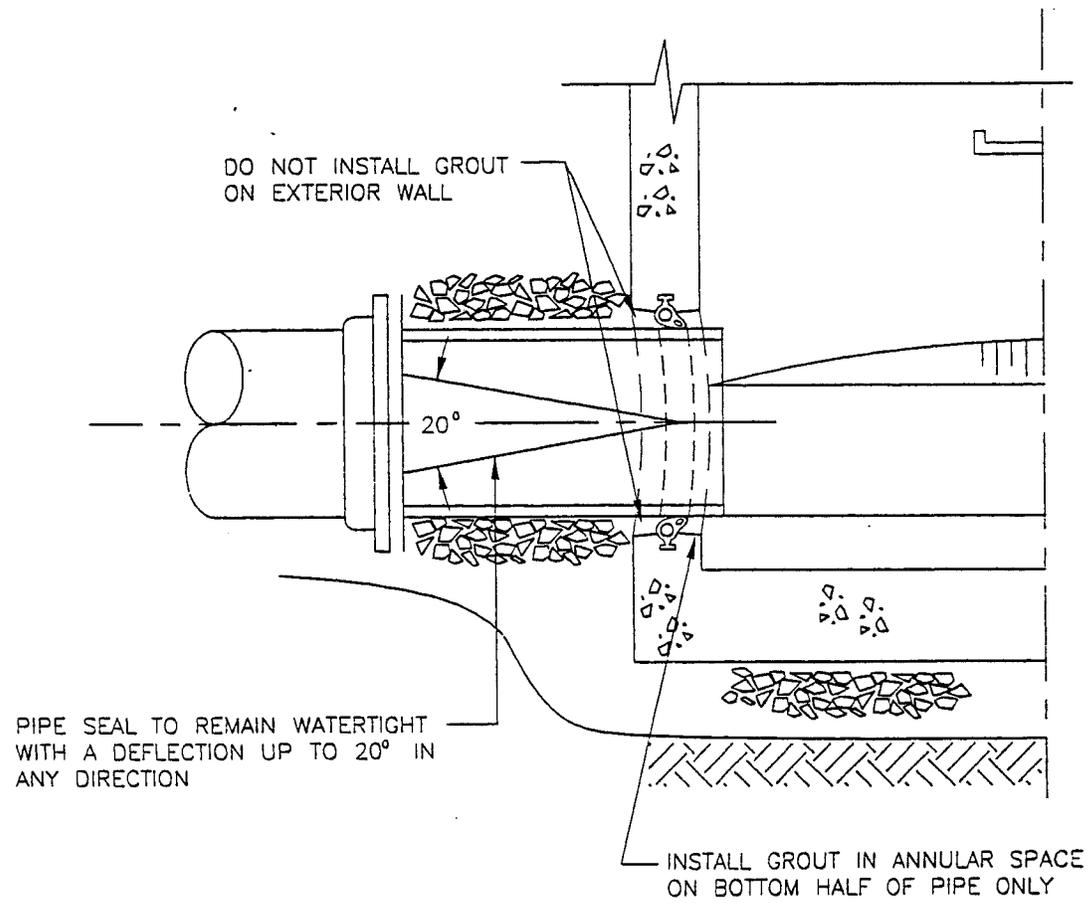
MANHOLE FRAME & LEVELING RINGS

- NOTES:
- 1.) ALL NON-SHRINK CEMENT GROUT SHALL BE TROWLED SMOOTH.
 - 2.) EXCESS PREFORMED FLEXIBLE PLASTIC JOINT SEALANT SHALL BE NEATLY TRIMMED FOR ALL JOINTS.

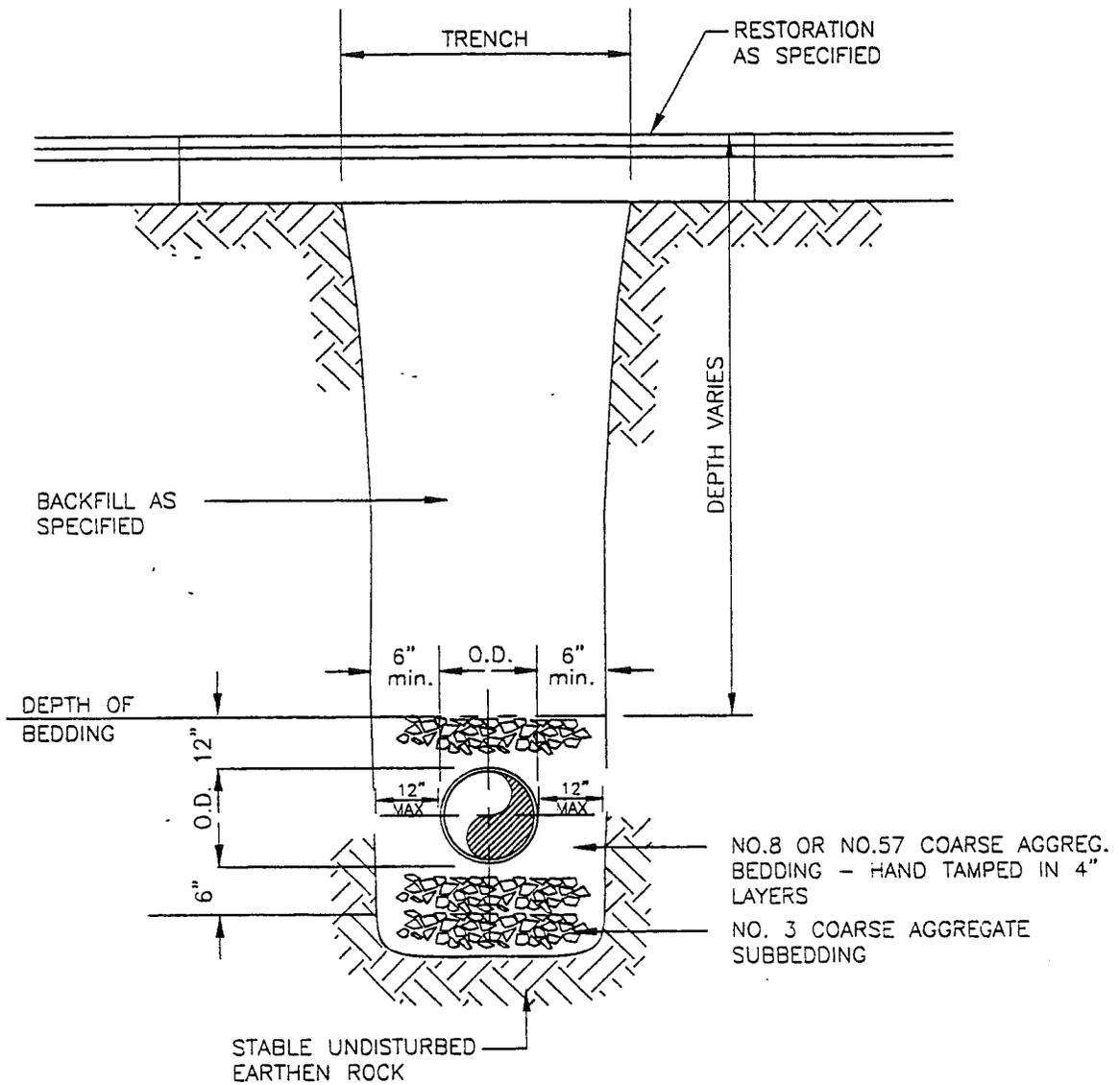
MANHOLE GASKETS, LEVELING RINGS,
AND BOLTED FRAME DETAIL



INTEGRAL PIPE GASKET
(BEFORE INSTALLATION)



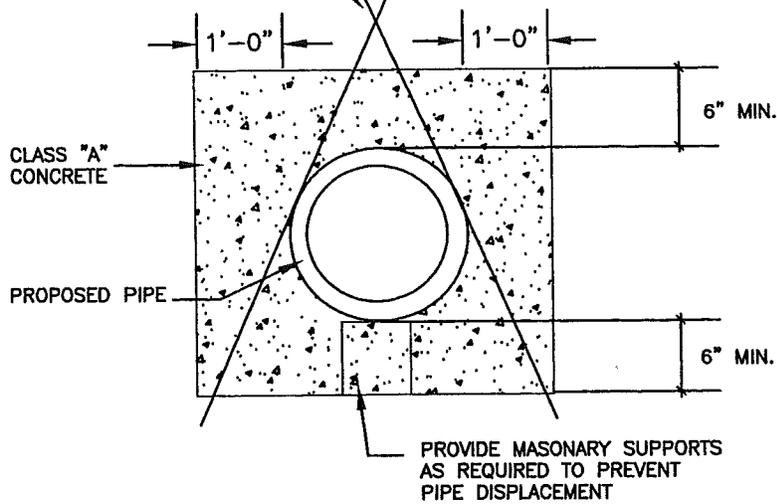
MANHOLE PIPE GASKET



- NOTE: 1. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.
 2. DETAIL FOR PIPE 4" AND LARGER.

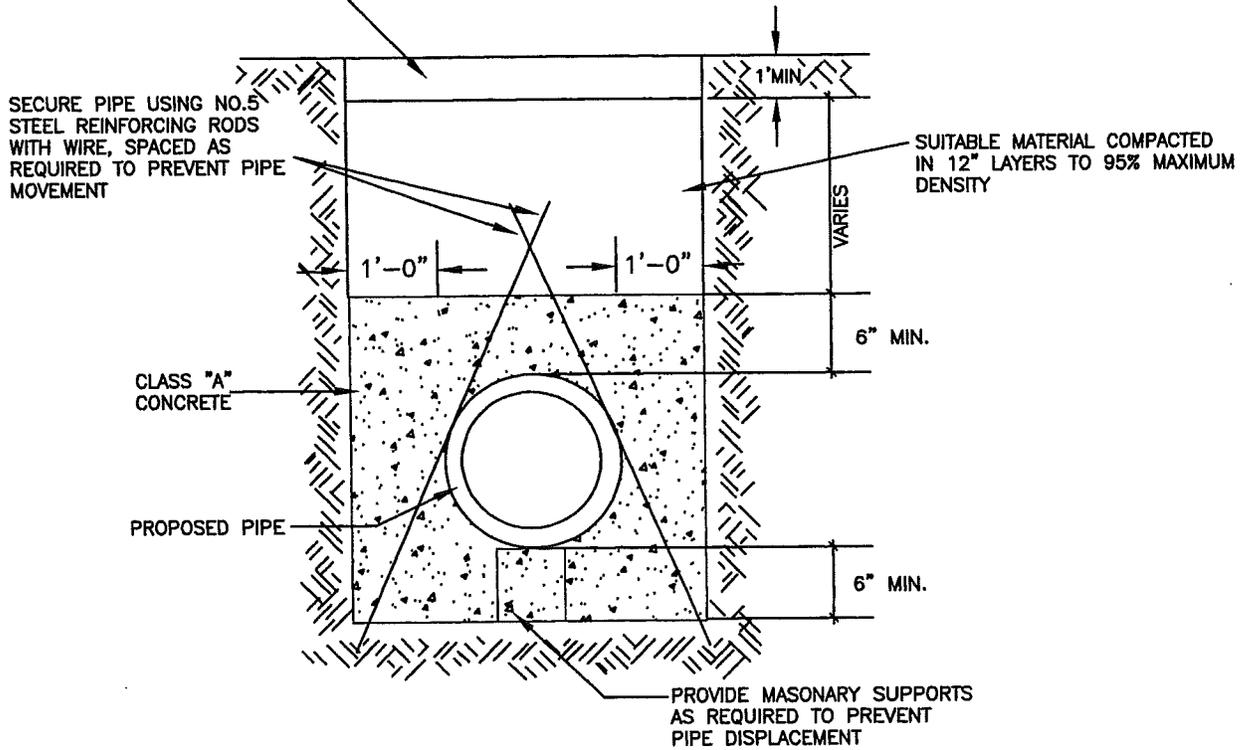
SANITARY SEWER BEDDING DETAIL
UNSTABLE MATERIAL EXCAVATION

SECURE PIPE USING NO.5
STEEL REINFORCING RODS
WITH WIRE, SPACED AS
REQUIRED TO PREVENT PIPE
MOVEMENT



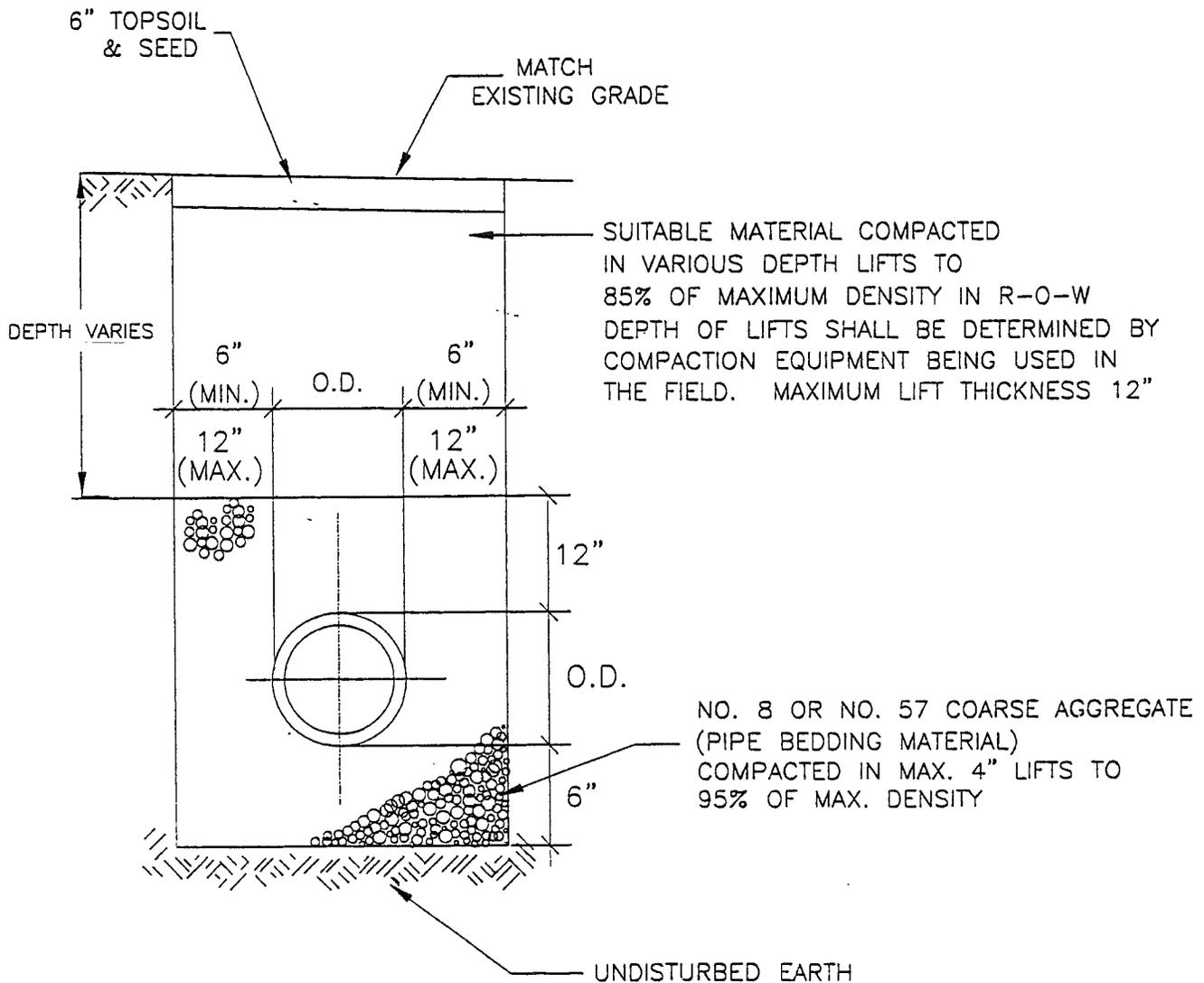
CONCRETE ENCASEMENT DETAIL

RIP-RAP - 75% BY WEIGHT
TO BE 6" OR LARGER



CONCRETE ENCASEMENT STREAM CROSSING DETAIL

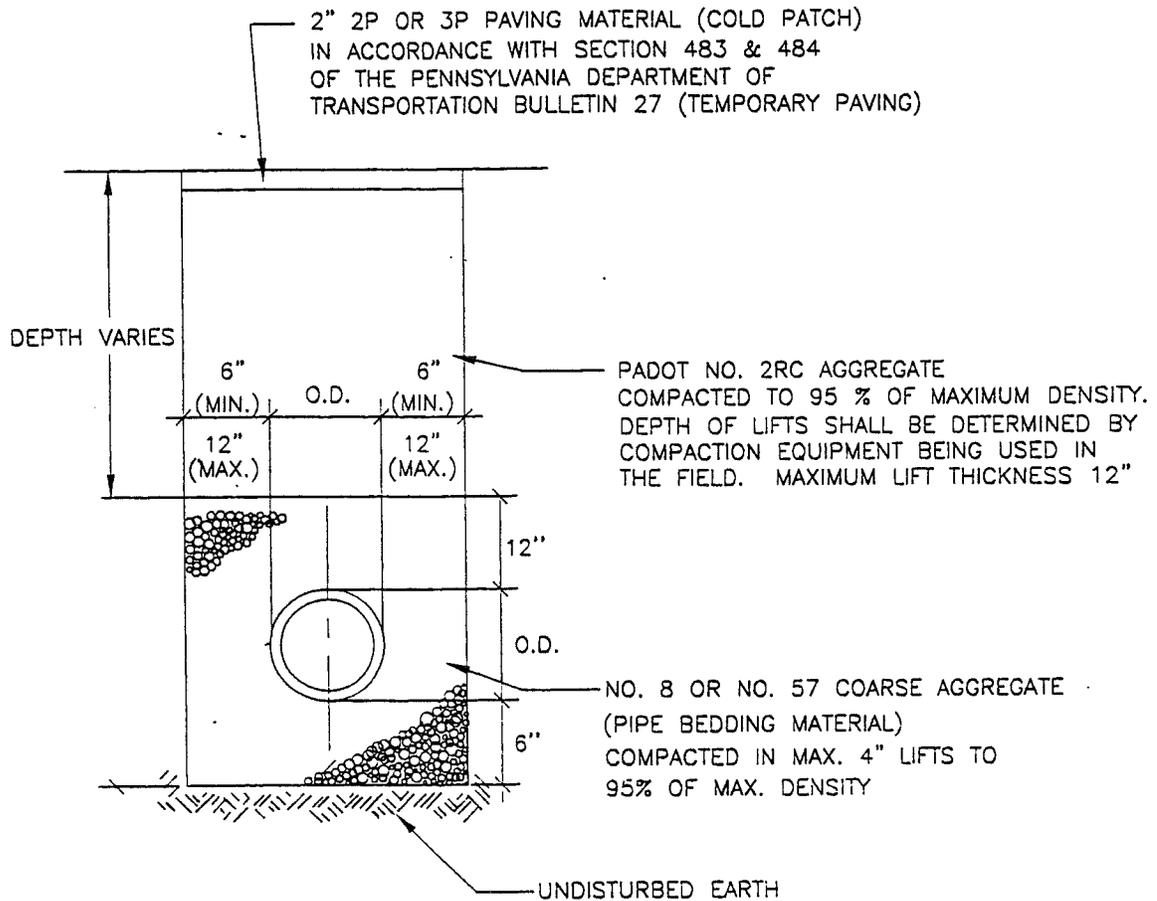
CONCRETE ENCASEMENTS



NOTES:

1. DETAIL FOR PIPE 4" AND LARGER.
2. CONTRACTOR TO PROVIDE UNIFORM GRADE FROM EDGE OF EXISTING R-O-W.

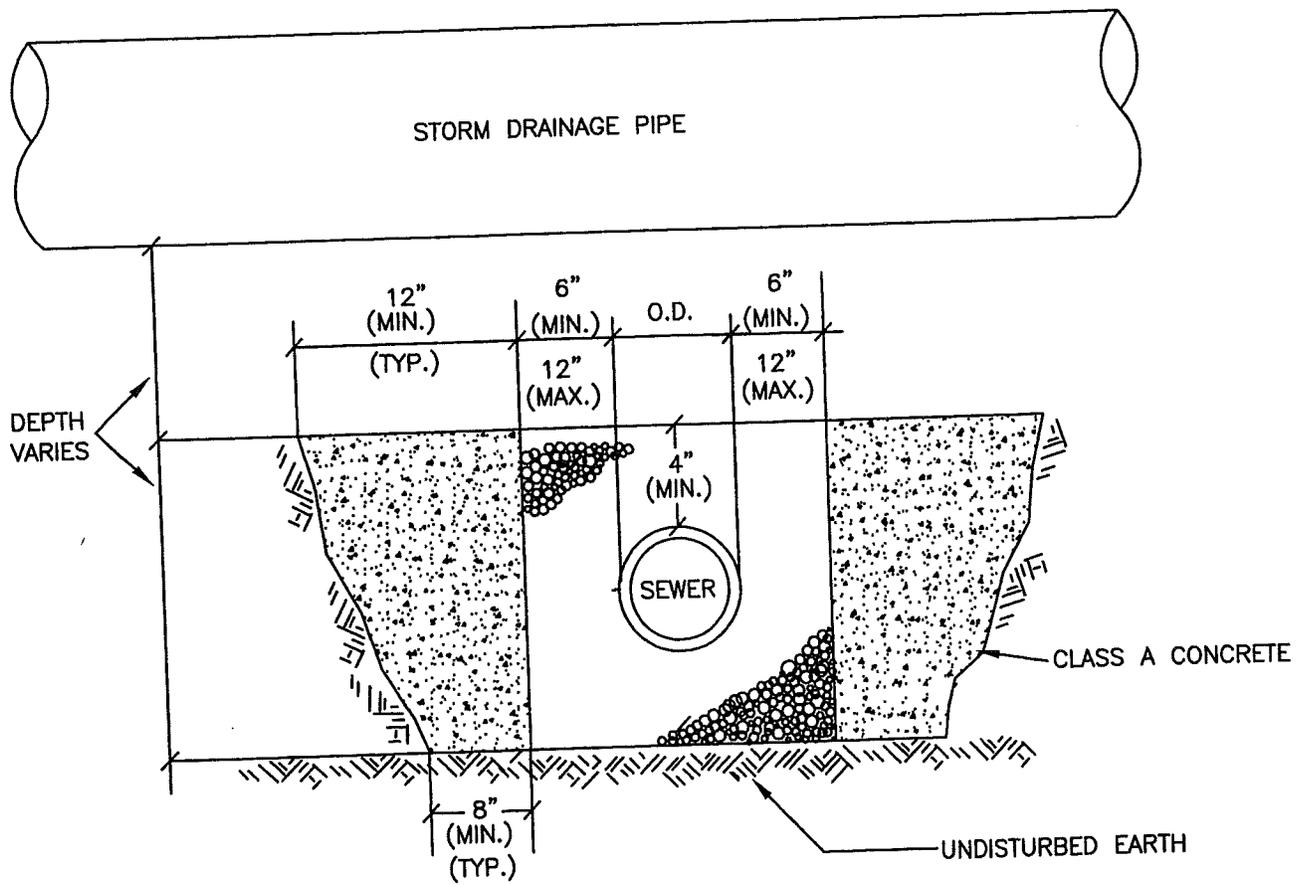
NON ROADWAY
PERMANENT RESTORATION



NOTES:

1. ALL MATERIALS AND CONSTRUCTION METHODS SHALL COMPLY WITH PENNSYLVANIA DEPARTMENT OF TRANSPORTATION SPECIFICATIONS. FORM 408 (1996)
2. CONTRACTOR TO PROVIDE UNIFORM GRADE FROM EDGE OF EXISTING PAVING.

TEMPORARY RESTORATION
IN TOWNSHIP ROADS & STATE ROADS



NOTES:

1. PIERS TO BE 5 FT. LONG CENTERED ON STORM DRAIN.
2. USE 3000 PSI CLASS A CONCRETE.
3. FORM PIERS AGAINST SOLID TRENCH WALLS.
4. PIERS REQUIRED WHEN CLEARANCE BETWEEN PIPES IS LESS THAN 18".

PIER SUPPORTS

